FALL
EDITION

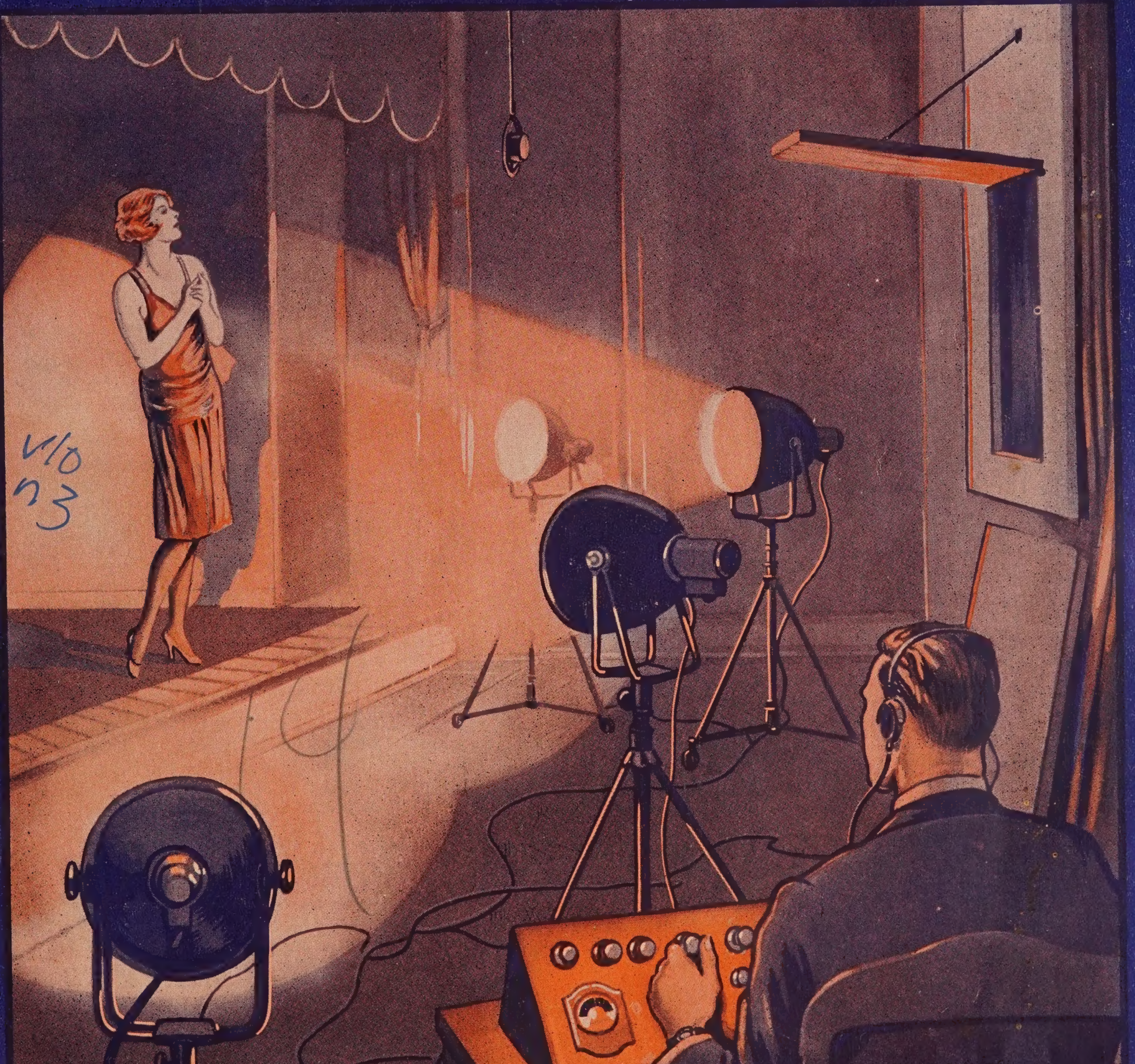
CITIZENS

50¢

Radio Call Book Magazine

N.S.E.

and Scientific Digest



SEE PAGE 51

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14

SERVICE - REPAIR - ENGINEERING
POWER AMPLIFICATION - TELEVISION

4 of the 40 Easy Ways to Make $3.00 an Hour In Your Spare Time in RADIO

THE four plans shown are but a sample of the many ways in which our members are making $3.00 an hour upwards, spare time and full time, *from the day they join the Association.* If you want to get into Radio, have a business of your own, make $50 to $75 weekly in your spare time, investigate the opportunities offered the inexperienced, ambitious man by the Association.

Our Members Earning Thousands of Dollars Every Week

The Association assists men to cash in on Radio. It makes past experience unnecessary. As a member of the Association you are trained in a quick, easy, practical way to install, service, repair, build and rebuild sets—given sure-fire money-making plans developed by us—helped to secure a position by our Employment Department. You earn while you learn, while you prepare yourself for a big-pay Radio position.

The Association will enable you to buy parts at wholesale, start in business without capital, help you get your share of the $600,000,000 spent annually for Radio. As a result of the Association, men all over the country are opening stores, increasing their pay, passing licensed operator examinations, landing big-pay positions with Radio makers.

REDUCE STATIC BY MARVELOUS NEW METHOD
MODERNIZE OLD SETS WITH ONE DIAL CONTROL
IMPROVE TONE AND VOLUME OF OLD SETS
RADIO-FY & ELECTRIFY PHONOGRAPHS

Below are a few of the reports from those now cashing in on the "40 Easy Ways"

Clears $3,000.00 Frank J. Deutch, Pa. — "Since joining the Association I have cleared nearly $2,000.00. It is almost impossible for a young fellow to fail, no matter how little education he has, if he will follow your easy ways of making money."

$1,100.00 in 6 Weeks J. R. Allen, Calif. — "Have done over $1,100.00 worth of business in the last 6 weeks. Next month I am going to open up a store of my own. I never knew that money could come so fast and easy."

$25.00 a Week Spare Time N. J. Friedrich, N. Y.—"I have averaged $25.00 a week for the last 7 months even though I am not a graduate but just learning."

Training Lands Him Job R. C. Kirk, N. C.—"Your training has been very valuable to me. I landed a job with the big department store out here a few weeks ago because I had my membership card with me. There were a large bunch of applications ahead of me."

ACT NOW If You Wish NO-COST Membership

For a limited time we will give to the ambitious man a No-Cost Membership which need not—should not—cost you a cent. For the sake of making more money now, and having a better position in the future, mail coupon below *now.* You'll always be glad you did.

RADIO
handbook
and Radio Log

Mail Coupon Today for the FREE HANDBOOK

It is not only chock-full of absorbing information about Radio, but it shows you how easily you can increase your income in your spare time. Mailing the coupon can mean $50 to $75 a week more for you.

Radio Training Association of America
4513 Ravenswood Avenue Dept. RCB-9, **Chicago, Illinois**

Radio Training Association of America
Dept. RCB-9, 4513 Ravenswood Ave., Chicago, Ill.

Gentlemen: Please send me by return mail full details of your Special No-Cost Membership Plan, and also a copy of your Radio Handbook.

Name ______________________________

Address ______________________________

City ____________________ *State* ____________

SEND YOUR ORDERS TO RADIO *Wholesale Headquarters*

Big Stock on Hand for Season's Opening

THE new radio season has opened and our shelves are loaded with a big stock of new, fresh merchandise, ready to supply the needs of our customers.

Last year our business increased so greatly that the factories were unable to supply our needs promptly, hence our customers were occasionally subjected to delays on their orders. This season our customers are going to get real service right from the start.

Here, all under one roof, with every floor heaped with new radio sets, kits, parts, short wave equipment, supplies, etc., you have the choice of the world's leading factories.

Try This New Improved Service

Braun Service now means quick service—prompt filling of orders, prompt answers to your letters, personal, intelligent consideration of your needs. Try out this new service. Send your orders to your *Wholesale Radio Headquarters* and get what you want quickly at low wholesale prices.

New A.C. Shield-Grid Sets New, Big Stocks

All the new developments in radio are here, ready for you. New A. C. Shield-Grid sets, new Shield-Grid tubes to meet dealers' demands, everything in kits and parts for the set-builder, many new lines, scores of brand-new items—new speakers, new cabinets, etc.

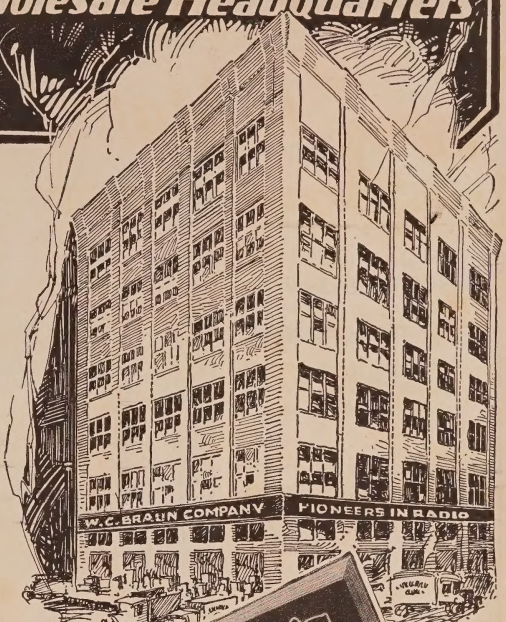
Get Our Catalog and Buyers' Guide First

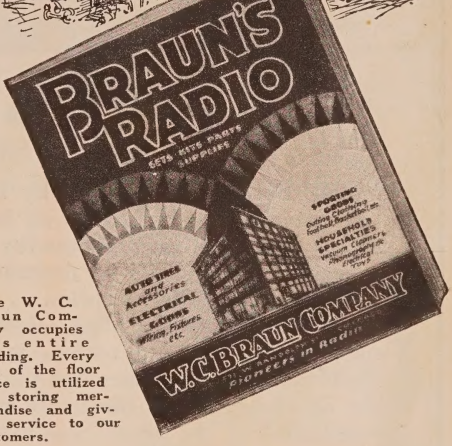
Get our catalog first before placing a single order this season. Not only will you save money, but you will be able to get what you want, a bigger selection from which to choose; and on top of that, you will get your orders filled more promptly.

Mail the Coupon Now for Free Copy

The new edition of Braun's Catalog & Buyers' Guide is full of surprises. It shows a large selection of merchandise at low prices. Be sure to send for a copy of this catalog at once. It is free. Use the handy coupon now.

W. C. BRAUN COMPANY
549 Randolph Street **Chicago, Ill.**


W. C. BRAUN COMPANY
PIONEERS IN RADIO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HOUSEHOLD SPECIALTIES Vacuum Cleaners Phonographs etc. Electrical Toys
AUTO TIRES and Accessories
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Pioneers in Radio

The W. C. Braun Company occupies this entire building. Every foot of the floor space is utilized for storing merchandise and giving service to our customers.

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Dear Sirs:

Please send me your new big Buyers' Guide showing big line of new goods at low wholesale prices.

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Street & Number..........

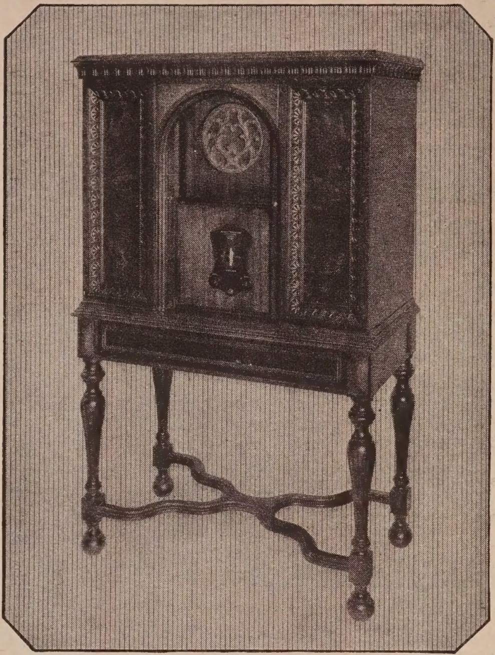
City..........

State..........

Single Dial

Dynamic Speaker

Push Pull Audio



100% Shielding

Unit Construction

Nine Tubes

Seven Seas Console

Shield Grid Tubes

THE Seven Seas Console by Leutz, custom radio builder, is an instrument of extraordinary fine quality built especially for those who demand the superlative in radio reception . . . perfect reproduction, hair-line selectivity, maximum range and volume without distortion. Many advancements in radio are developments of the Leutz laboratory. And, in the Seven Seas Console, Leutz takes the lead again by being the first to introduce an A/C console using the superior A/C Shield Grid Tubes, giving much greater radio frequency amplification than heretofore obtainable.

For yacht or home no finer console is made. The speaker is of the highest quality dynamic type, and the walnut cabinet is a work of art.

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Franchise applications are invited

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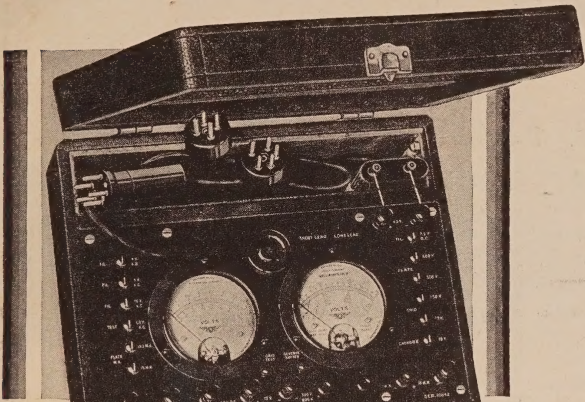
ALTOONA ~ ~ ~ PENNSYLVANIA, U. S. A.

West Coast Representative:

B. J. HOWDERSHELL, Detwiler Bldg., 412 W. Sixth Street, Los Angeles, Cal.

Citizens Radio Call Book Magazine and Scientific Digest, September, 1929. Published 4 times yearly, January 1, March 1, September 1, November 1. Volume X, No. 3. Published at Chicago, Ill. Subscription price, $1.75 yearly. Entered as second-class matter March 17, 1927, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.
Citizens Radio Service Bureau, Inc., Publishers, 508 So. Dearborn St., Chicago.

JEWELL
199 SET ANALYZER
A High Grade Instrument Backed by a thorough Data Service



THE inherent accuracy and complete reliability of the Pattern 199 have gained for it the confidence of service men from coast to coast.

Nearly thirty years' manufacturing experience, combined with painstaking care in design, has perfected the large 3¾ inch face instruments used in the 199. Thousands of these instruments have been proved in exacting industrial applications.

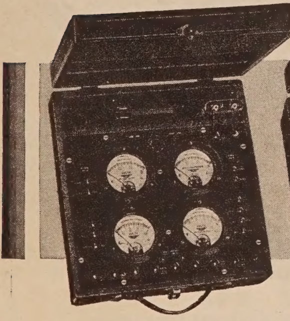
The Jewell 199 not only makes every worth while radio test, but does it accurately, stands up well in service, and at the same time is the lowest priced, high grade set analyzer on the market today.

In addition to the high quality and low cost of the Jewell Pattern 199, it is backed by the most thorough and complete data service available. Jewell "Instructions for Servicing Radio Receivers," furnished with every Pattern 199 Set Analyzer, contains checking data on sets of leading radio manufacturers.

List Price, Pattern 199 - $97.50
Dealers' Price - - $73.12

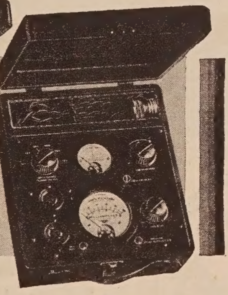
Pattern 198, which includes the 199 in a large case with compartments for replacement tubes and tools

List Price - - - $110.00
Dealers' Price - - $82.50



Pattern 409, 4-Instrument Set Analyzer, designed especially for expert radio service men, gives plate voltage, plate current, filament, and grid voltages simultaneously. Same high quality throughout as Pattern 199.

List Price, Pattern 409, $122.50
Dealers' Price $91.88



Jewell Pattern 210 Tube Tester gives direct reading on all tubes from UV199 to UX250, including half and full wave rectifier and screen grid tubes. Every dealer should have this valuable tube tester.

List Price, Pattern 210, $65.00
Dealers' Price $48.75

Mail the coupon for a free copy of the valuable booklet, "Instructions for Servicing Radio Receivers."

Instructions for Servicing Radio Receivers

29 YEARS MAKING GOOD INSTRUMENTS
JEWELL
JEWELL
199 Set Analyzer

Jewell Electrical Instrument Company
1650 Walnut Street, Chicago, Illinois

Please send us your booklet, "Instructions for Servicing Radio Receivers," and literature covering Jewell High Grade Radio Service Instruments.

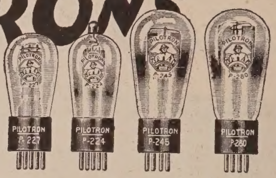
Name---------------------------------

Address-------------------------------

PILOT

presents

PILOTRONS

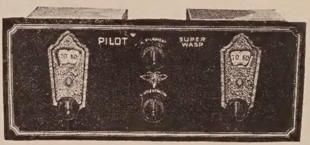


"BUILT FOR PROFESSIONALS"

PILOTRONS, "built for professionals" are especially designed and constructed for the professional radio engineer, custom set-builder and advanced amateur—an audience which is super-critical and *has a right to be.* Moreover, new type Pilotrons are available many months before you can obtain newly-developed tubes from the usual sources. This gives custom-set builders an opportunity to use new tubes *long before they are available in manufactured receivers.* Pilot's self-contained manufacturing policy provides definitely superior tubes at less than the usual prices. *Stocked by all Pilot authorized agencies*

SHORT-WAVE ENTHUSIASTS

Would you know the thrill of roaming the world with a Super-Wasp? Do you know that down among the short waves are oodles of ententertainment, international in scope—unique—startlingly different from the hackneyed time-worn programs? For a few dollars and a few hours "work" using only screw driver and pliers you can assemble the Pilot Double Duty Super-Wasp, designed by Robert S. Kruse, international short wave authority. Covers all wave bands from 14 to 500 meters, making it a *combination* short wave and broadcast receiver of exceptional sensitivity, utilizing the famous *screen grid tube. Hear the Super-Wasp at any authorized Pilot Agency.*



Custom Set-Builder's Price

$29.50

Slightly Higher West of the Rockies

TRADE MARK REGISTERED

RADIO DESIGN NOW OFFICIAL GUILD ORGAN

By subscribing now for Radio Design Quarterly you secure free membership in Radio International Guild, *a world-wide organization* of radio engineers, advanced experimenters, custom set-builders and radio fans. Send 50c for subscription to Radio Design, Department E, 103 Broadway, Brooklyn, New York.

QUALIFIED DEALER'S OPPORTUNITY

In addition to being financially responsible, Pilot dealers must be technically qualified to discuss radio construction problems intelligently with custom set-builders, advanced experimenters, etc. If interested in becoming an *Authorized Pilot Agent* write at once for details.

PILOT RADIO & TUBE CORP.

WORLD'S LARGEST RADIO PARTS PLANT

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BROOKLYN NEW YORK
U. S. A.

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RICH REWARDS in RADIO
Be a Radio Expert

MEN! Here's the 'dope' you've been looking for

HOW TO GET INTO THE RADIO BUSINESS~

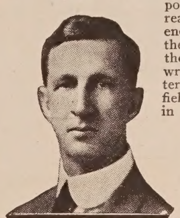
J.E.S.

Many Earn $50 to $250 a Week in Work That is Almost Romance

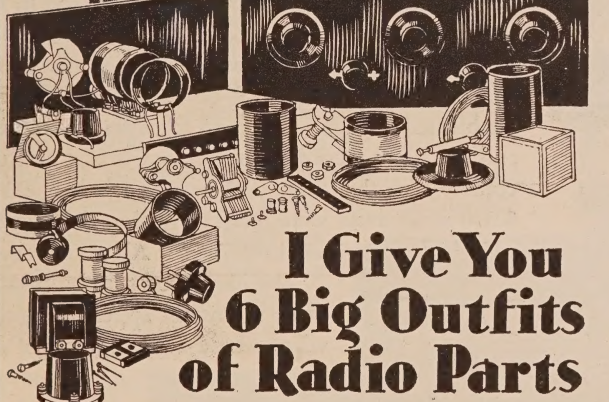
If you're earning a penny less than $50 a week, clip coupon now for FREE BOOK! New 64-page book pictures and tells all about the Radio business, hundreds of opportunities—in work that is almost romance! YOU can learn quickly and easily at home, through my tested, proved methods, to take advantage of these great opportunities! Why go along at $25, $35, or $45 a week when you can pleasantly and in a short time learn how to hold the big-pay jobs?

Clip Coupon for Free Book

Don't envy the other fellow who's pulling down the big cash! My proven home-study training methods make it possible for you, too, to get ready for better jobs, to earn enough money so you can enjoy the good things of life. One of the most valuable books ever written on Radio tells how—interesting facts about this great field, and how I can prepare you in your spare time, at home, to step into a big-pay Radio job. GET THIS BOOK. SEND COUPON TODAY.



J. E. SMITH, Pres.
National Radio Institute
Dept. 9WD
Washington, D. C.



I Give You 6 Big Outfits of Radio Parts

With them you can build 100 different circuits—learn the "how" and "why" of practically every type of Radio set made. This kind of training fits you to step into the good jobs—sends you out an experienced Radio expert. When you complete, my Employment Department will help you get a real big Radio job like Graduate Edward Stanko, now Chief Operator of Station WGR, or Frank M. Jones, 922 Guadalupe St., San Angelo, Tex., builder and operator of Station KGFI and Manager of the best equipped Radio shop in the Southwest, or help you start a Radio business of your own like Richard Butler, 1419 No. 17th St., Philadelphia, Pa., who made around $500 a month compared with a small salaried, no future job as a motorman when he enrolled.

My Radio Training is the Famous "Course That Pays for Itself"

Spare time earnings are easy in Radio almost from the time you enroll. G. W. Page, 1807 21st Ave., S., Nashville, Tenn., made $935 in his spare time while taking this course. Al. Johnson, 1409 Shelby St., Sandusky, O., $1,000 in four months, and he didn't know the difference between a condenser and a transformer when he enrolled. I'll give you a legal contract, backed by N. R. I. pioneer and largest home-study Radio school in the world, to refund every penny of your money if you are not satisfied, upon completing, with the lessons and instructions received. Find out what Radio offers you—get the facts. Mail coupon—RIGHT NOW.

I Have Trained Hundreds of Men at Home for Big Radio Jobs. My Book Proves I Can Do the Same for You.

RADIO NEEDS TRAINED MEN!

ACT NOW~COUPON BRINGS MY FREE BOOK

J. E. Smith
President,
National Radio Institute
Dept. 9WD
Washington, D. C.

Dear Mr. Smith:
Without obligating me in any way, send me your big FREE BOOK, "Rich Rewards in Radio," and all information about your practical home-study, Radio Course.

Name..Age............
Address..
Town..State..........

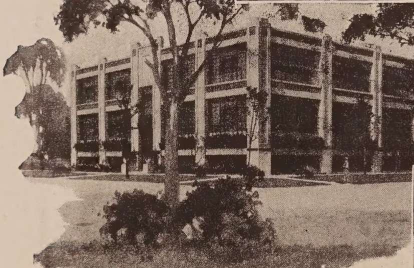
THE FINE THINGS ARE HAND MADE

SCOTT CUSTOM

A NATION WIDE

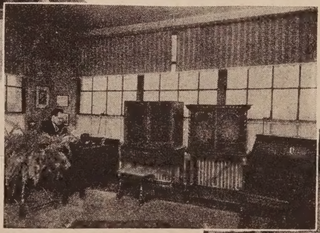
FROM A SEED PLANTED FOUR YEARS LISHED THE WORLDS RECORD FOR

E. H. SCOTT



FOUR years ago, in the early days of the application of mass-production methods to radio manufacturing, E. H. Scott assumed an attitude diametrically opposed to current thought. He contended that the best product of factory methods could ***never*** even ***approximate*** the performance possible to obtain from a receiver custom-made in the laboratory. He gave his thought material form and the resulting instrument, which was destined to become known as the Scott World's Record Receiver, established the world's record for distant reception and the Scott records stand unapproached and uncontested to this date. 117 programs, all 6,000 to 8,000 miles away were received during the thirteen week test period. All were verified.

The idea of custom-built radio made an instant appeal to people who wanted what the best of the "ordinary" sets could not give them—and these people were will-



Corner of Studio

Research Laboratory

Experimental Laboratory

The World's Records Held by Scott Radio

We repeat our challenge to ANY Radio Manufacturer to show a better *verified* DX record than that listed below.

1—A better record for a number of broadcasting stations heard from 6000—8000 miles distant.

6—Stations heard—*distance* 6000 *miles.*
7—Stations heard—*distance* 7000 *miles.*
6—Stations heard—*distance* 8000 *miles.*

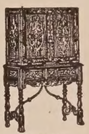
2—A better record for number of programs heard from stations distant 6000 or more miles over a period of from one to three months.

19—programs from stations 8000 *miles away.*
19—programs from stations 7000 *miles away.*
79—programs from stations 6000 *miles away.*

SCOTT TRANSFORMER COMPANY,

BUILT RADIO

Below are sketched a few of the Scott Custom-made consoles which constitute the first line of radio furniture made to the same high standard as your other home furnishings.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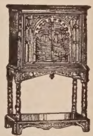
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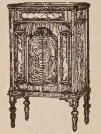
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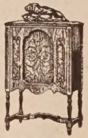
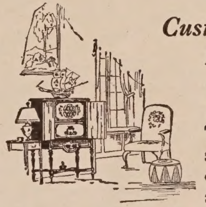

MILFORD

INSTITUTION WHICH HAS GROWN AGO WHEN E. H. SCOTT ESTAB— RADIO RECEIVER PERFORMANCE

ing to pay for the comparatively costly laboratory method necessary to duplicate the performance of the ***original*** Scott World's Record Receiver. And they are still willing to pay for Scott laboratory precision —more willing than ever before. They are *eager* to pay for Scott custom-building when they experience the tremendous power, the exact selectivity and the tonal perfection made possible thereby. In fact, the market for Scott Custom-Built Radio has grown to such proportions that the Scott Laboratory, where Scott Receivers are laboratory-made, has become the greatest institution of its kind in the world.

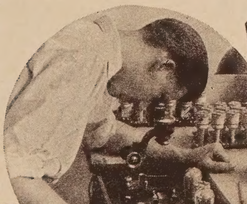
One of the seven thousand qualified Scott sales and service representatives scattered throughout the nation will gladly discuss Scott Radio with you. The price range is between $300 and $8,000.

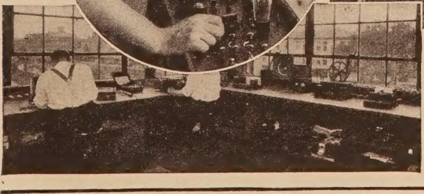
Write for name of nearest Scott Representative

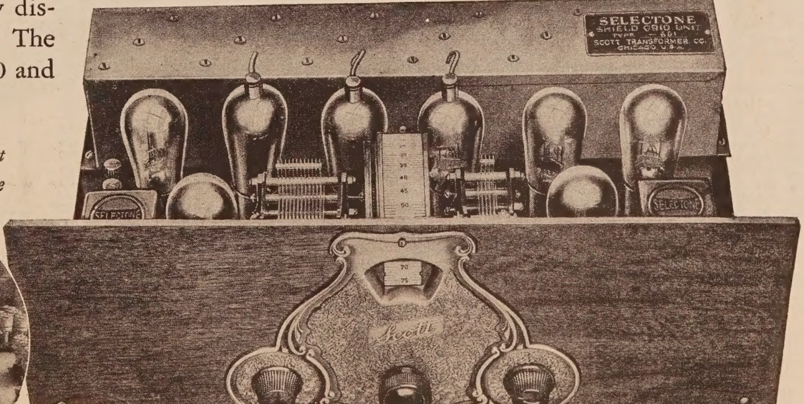


Custom-Built Period Cabinets

To exactly suit the acoustical and mechanical requirements of the Scott Custom Built Chassis, there are fifteen especially designed period cabinets. All are custom-made to the very highest standards of furniture craftsmanship and present a range of design variation adequate to suit every taste. Such fine cabinet work has never been shown in the field of radio furniture before.


Precision Coil Matching


Airtest Room



THE SCOTT A. C. SHIELD-GRID 10

The newest model of Scott World's Record Custom-Built Radio combines the advantages of world's record performance with the convenience of direct A-C operation. "All the world" is on the single dial of the SCOTT A.C. SHIELD GRID 10 and it is certain that you will not only be pleased, but thrilled and amazed at the realism of its tone.

A limited amount of unfranchised territory is still open. If you are interested in selling the best there is in radio and in operating in a protected market, write at once for qualification blank

4450-64 RAVENSWOOD AVE., CHICAGO

Citizens Radio Call Book Magazine

AND SCIENTIFIC DIGEST

Registered in U. S. Patent Office
Established 1921
Executive Offices:
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SEPTEMBER, 1929 Published January, March, September, November Vol. 10, No. 3

CONTENTS THIS ISSUE

Roster of Columbia, NBC and ABC Chain Stations 10
Up-to-the-minute U. S. Broadcast Station List 10, 30
Consolidated U. S. Broadcast Calls 32
U. S. Broadcast Stations by Frequency 34
U. S. Broadcast Stations by States 36
Canadian Broadcast Stations 38
Short Wave Phone and Telegraph Stations 38
Television Broadcast Stations 38
Foreign Broadcast Stations 38
Foreign Broadcast Stations (continued) 39
Map of U. S. 40, 41
Mileage Chart of Air Line Distances 42, 43
Handy Log Chart 44
Ampere Andy's Assistors 46, 47, 48
S-M 722 A.C. Screen Grid Receiver 49, 50
Radio's Part in the Talkies 51, 52, 53
Aero A. C. Short Wave Converter 54
Custom Built World's Record Shield Grid A. C. 10 55, 56
Thordarson R-245 Push-Pull Amplifier and Power Supply 57
C. R. Leutz "Seven Seas" Console Receiver 58, 59
Walker Multi-Unit for Fans or Service Men 60
Keystone Electric 67 Receiver Kit 61, 62
HFL Mastertone Receiver 63, 64
Lincoln 8-40 Screen Grid Super 65, 66
Remler Type 111 Screen Grid Receiver and Amplifier 67, 68
S-M 735 Short Wave Receiver 69, 70
Universal Power Amplifier and B Supply 71
Radio Engineering Department 72, 73, 74
Power Amplification Department 75, 76, 77, 78, 79

Service and Repair Department:

Majestic Model 70 Receiver 80
Kolster Four Tube Receiver 81
Sparton a. c. 89 Receiver 82
Bremer-Tully 7-70 Receiver 83
DayFan Model 5080 84
Balkeit Model A Receiver 85
Fada 7 a. c. Receiver 86
Freshman 2-N-12 Receiver 87
Steinite Model 261 Receiver 88
Howard Green Diamond Model 8 Receiver 89
With the Professional Set Builder 90, 91, 92
Eliminating Sign Flasher Interference 93, 94
ABC of Radio Section 95, 96
Practical Television 97
Radio Used to Find Buried Treasures 98
Horse's Heart Beat Amplified by Radio 99
Radio Set on Dash of Car 100
Largest Man-Made Lightning Bolt 101
With the Accessory and Parts Manufacturers 102, 103
Blue Print Page 144
Index to Advertisers 150

In This Issue

COMPLYING with readers' opinions expressed in the questionnaire which we published on page 117 of the March 1929 issue, we are adding a new department to the magazine known as the Radio Engineering Section and greatly elaborating two other departments which have proven quite popular, one being the Power Amplification Department and the other the Service and Repair Department. In the latter we are printing ten schematics of as many popular factory built receivers and their power supplies to enable service men to be fully conversant with models of sets upon which service might now be required. It is obvious that the latest models will not require immediate service and hence this department will concern itself only with the older models in which there might be a possibility of either service or repair.

Many of the newest kits are described in this issue. Some of these were announced at the radio trade show in Chicago, while others are even more recent than that. There is a wide range of receivers from superheterodyne to tuned radio frequency sets. While the a. c. 224 screen grid tube is quite popular, nevertheless the 227 comes in for a good share of attention.

Although public interest in television has not maintained its anticipated activity during the summer, nevertheless with the licensing of a number of transmitters it is expected that some interest will be created on the part of the experimenter.

For the broadcast listener we have added a page of consolidated calls, a map of the U. S. and a mileage chart of air line distances, all of which should make it possible for the listening fan to secure all the information he desires about a station.

The Editor.

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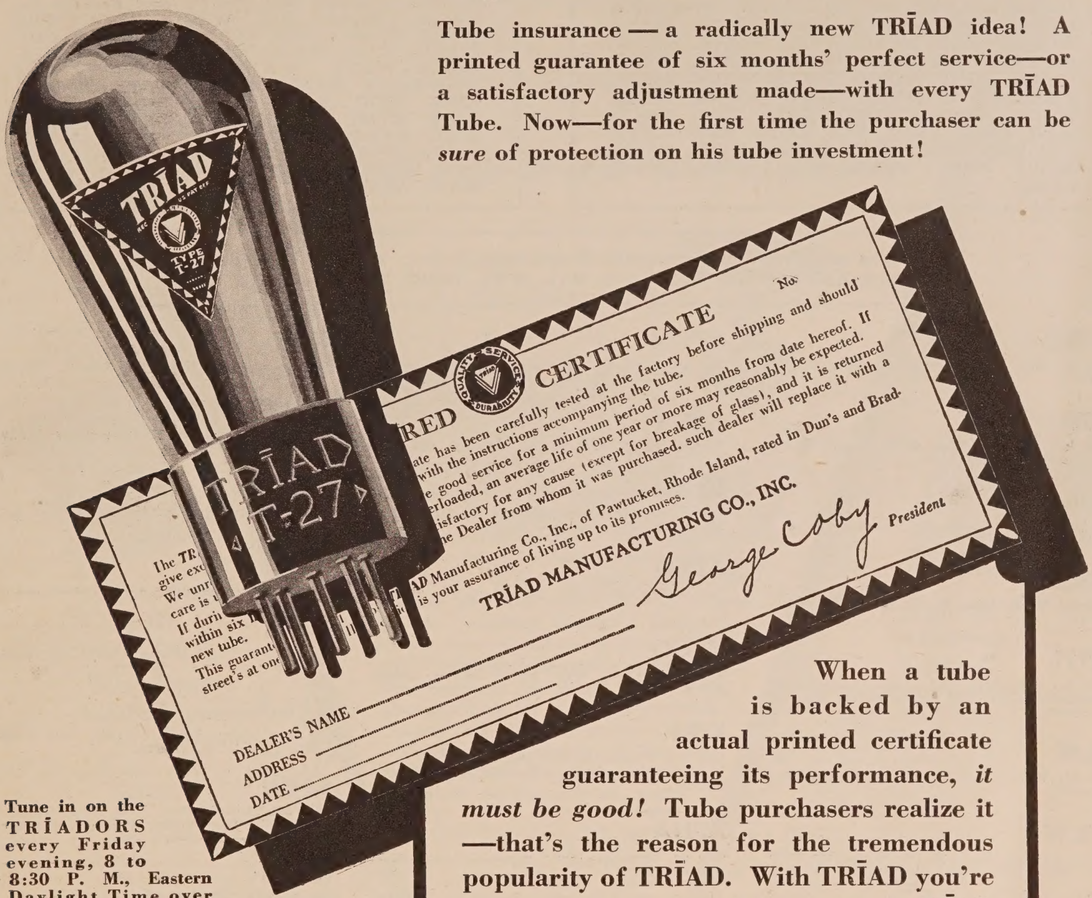
positive protection for the tube purchaser

Tube insurance — a radically new TRĪAD idea! A printed guarantee of six months' perfect service—or a satisfactory adjustment made—with every TRĪAD Tube. Now—for the first time the purchaser can be *sure* of protection on his tube investment!



RED CERTIFICATE

No.

ate has been carefully tested at the factory before shipping and should
with the instructions accompanying the tube.
e good service for a minimum period of six months from date hereof. If
erloaded, an average life of one year or more may reasonably be expected.
isfactory for any cause (except for breakage of glass), and it is returned
he Dealer from whom it was purchased, such dealer will replace it with a

AD Manufacturing Co., Inc., of Pawtucket, Rhode Island, rated in Dun's and Brad-
is your assurance of living up to its promises.

TRĪAD MANUFACTURING CO., INC.
George Coby President

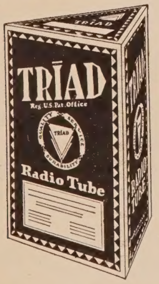
The TR
give exc
We unr
care is u
If durin
within six
new tube.
This guarant
street's at one

DEALER'S NAME
ADDRESS
DATE

When a tube is backed by an actual printed certificate guaranteeing its performance, *it must be good!* Tube purchasers realize it —that's the reason for the tremendous popularity of TRĪAD. With TRĪAD you're *sure* of quality even before you buy. TRĪAD quality is definitely *proved* by the very fact that an insurance certificate is packed in every TRĪAD carton — guaranteeing a minimum of six months' service or a satisfactory adjustment to the user. There's protection for you — protection that is *built* on quality. Try TRĪADS—once— that's all we ask. We know you'll use *only* TRĪAD after a single trial. Speak to your nearest TRĪAD dealer—today!

TRĪAD MANUFACTURING CO., Inc.
TRĪAD BLDG., BLACKSTONE, MIDDLE & FOUNTAIN STS.
PAWTUCKET, R. I.

Tune in on the TRĪADORS every Friday evening, 8 to 8:30 P. M., Eastern Daylight Time over WJZ and associated NBC Stations.



"Ask for the tube in the black and yellow triangular box."

American Broadcasting Stations

Station assignments shown in the following pages were made by the Federal Radio Commission. This list is revised from issue to issue and is therefore up-to-the-minute. Initials such as E, C, M, and P denote Eastern, Central, Mountain and Pacific time.

Stations associated with the Columbia Broadcasting System: WABC, W2XE, WOR, WEAN, WNAC, WCAU, WFAN, WCAO, WFBL, WMAK, WKBW, WLBW, WJAS, WHK, WADC, WMAL, WSPD, WKRC, WGHP, WOWO, WMAQ, WBBM, KMOX, KMBC, KOIL, WDBJ, WTAR, WWNC, WLAC, WDOD, WBRC, WREC, KFJF, KFH, KRLD, WRR, KTSA, KRLA, KLZ, KDYL, KYA, KMTR, KJR, KEX, KGA, WCCO, WRHM, WISN, WDSU, WIBW, WAIU, WFBM, WHEC, CFRB, CKGW, CKAC.

Stations associated with the National Broadcasting System: WEAF, WJZ, WEEI, WBZA, WBZ, WTIC, WJAR, WTAG, WCSH, WFI, WLIT, WRC, WBAL, WGY, WGR, WHAM, WCAE, KDKA, WTAM - WEAR, WWJ, WJR, WLW - WSAI, WGN-WLIB, WENR, WLS, KYW-KFKX, KSD, KWK, WOC, WHO, WOW, WDAF, WREN, KSTP, WTMJ, KOA, WHAS, WSM, WMC, WSB, WBT, KVOO, WFAA, KPRC, WOAI, WBAP, WRVA, WJAX, KPO, KGO, KFI, KGW, KOMO, KHQ, WEBC, KSL, WKY, WFJC, WCFL, WPTF, WAPI, WSMB, WIOD, KTHS.

Stations associated with the American Broadcasting System: KGA, KEX, KJR, KYA, KMTR, KDYL, KFAB, KLZ, WOQ, WIL, WMT, WIBO, WRHM, KFBK.

KCRC

1370 kc, Enid, Okla., Champlin Refining Co., 100 w, C.

KDB

1500 kc, Santa Barbara, Calif., Santa Barbara Broadcasting Co., 100 w, P.

KDKA

980 kc, East Pittsburgh, Pa., Westinghouse E. & M. Co., 50,000 w, E.

KDLR

1210 kc, Devils Lake, N. D., Radio Electric Co., 100 w.

KDYL

1290 kc, Salt Lake City, Utah, Intermountain Broadcasting Corp., 1000 w, M, "On the Air, Goes Everywhere.

KEJK

1170 kc, Beverly Hills, Calif., R. S. MacMillan, 500 w, P.

KELW

780 kc, Burbank, Calif., Earl L. White, 500 w, P, "The White Spot of the San Fernando Valley."

KEX

1180 kc, Portland, Ore., Western Broadcasting Co., 5000 w, P, "A Public Service Necessity."

KFAB

770 kc, Lincoln, Neb., Nebraska Buick Automobile Co., 5000 w, C, "Home, Sweet Home."

KFAD

620 kc, Phoenix, Ariz., Electric Equipment Co., 500 w, M, "Phoenix, Where Winter Never Comes."

KFBB

1360 kc, Havre, Mont., Buttrey Broadcast, Inc., 500 w, M.

KFBK

1310 kc, Sacramento, Calif., James McClatchy Co., 100 w, P.

KFBL

1370 kc, Everett, Wash., Leese Bros., 50 w, P, "The Voice of Puget Sound."

KFDM

560 kc, Beaumont, Tex., Magnolia Petroleum Co., 500 w, C, "Kall for Dependable Magnolene."

KFDY

550 kc, Brookings, S. D., State College, 500 w, C.

KFEL

940 kc, Denver, Col., Eugene P. O'Fallon, Inc., 250 w, M, "The Argonaut Station."

KFEQ

560 kc, St. Joseph, Mo., Scroggin & Co., 2500 w, C.

KFGQ

1310 kc, Boone, Iowa, Boone Biblical College, 100 w, C.

KFH

1300 kc, Wichita, Kan., Hotel Lassen, 500 w, C, "Kansas' Finest Hotel, in the Very Heart of God's Country."

KFHA

1200 kc, Gunnison, Colo., Western St. College of Colorado, 50 w.

KFI

640 kc, Los Angeles, Calif., Earl C. Anthony, Inc., 5000 w, P, "National Institution."

KFIF

1420 kc, Portland, Ore., Benson Polytechnic School, 100 w, P.

KFIO

1230 kc, Spokane, Wash., North Central High School, 100 w day, P.

KFIZ

1420 kc, Fond du Lac, Wis., Reporter Printing Co., 100 w, C.

KFJB

1200 kc, Marshalltown, Iowa, Marshall Electric Co., 100 w, C, "Marshalltown, the Heart of Iowa."

KFJF

1470 kc, Oklahoma City, Okla., National Radio Mfg. Co., 5000 w, C, "Radio Headquarters of Oklahoma."

KFJI

1370 kc, Astoria, Ore., Geo. Kincaid, 100 w, P.

KFJM

1370 kc, Grand Forks, N. D., University of North Dakota, 100 w, C.

KFJR

1300 kc, Portland, Ore., Ashley C. Dixon & Son, 500 w, P.

KFJY

1310 kc, Ft. Dodge, Iowa, C. S. Tunwal, 100 w, C.

KFJZ

1370 kc, Ft. Worth, Texas, Henry Clay Meacham, 100 w, C.

KFKA

880 kc, Greeley, Colo., Colorado State Teachers College, 500 w, M. Shared.

KFKB

1050 kc, Milford, Kan., J. R. Brinkley, M. D., 5000 w, C, "The Sunshine Station in the Heart of the Nation."

KFKU

1220 kc, Lawrence, Kan., University of Kansas, 1000 w, C, "Up at Lawrence on the Kaw."

KFKX

See under KYW.

KFKZ

1200 kc, Kirksville, Mo., Northeast Missouri State Teachers College, 15 w, C, "Kirksville, the Home of Osteopathy."

KFLV

1410 kc, Rockford Ill., A. T. Frykman, 100 w, C.

KFLX

1370 kc, Galveston, Texas, Geo. Roy Clough, 100 w, C.

KFMX

1250 kc, Northfield, Minn., Carleton College, 1000 w, C.

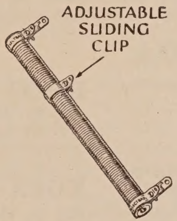
KFNF

890 kc, Shenandoah, Iowa, Henry Field Seed Co., 500 w, C, "Known for Neighborly Folks."

You Can Spend a Lot More and Get Less
—*But You Can't Spend Less and Get More*

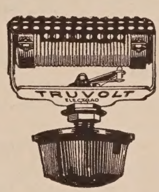
VALUE in radio equipment is like value in everything else. You can get a lot of quality at small cost *if you know how to choose.* The *safe* way is to *follow the leaders*—do what the engineers do; buy what they buy. Electrad invites you to select your voltage and volume controls on that basis. Radio engineers the world over respect the name "Electrad." They know it means perfection at the lowest possible price.

TRUVOLT All-Wire Resistances

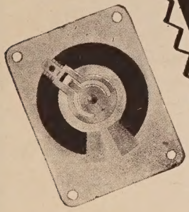


Safest for Your Eliminator or Power Pack

U. S. Pat. 1676869 & Pats. Pend.



U. S. Pats. 1034103—1034104—& Pats. Pend.

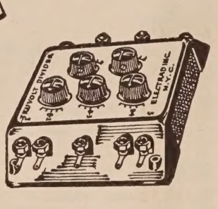


Super-TONATROL High-Power Volume Control

A new Electrad development without a parallel. Perfect control of high voltages, with rapid heat dissipation in excess of five watts, unequalled smoothness and *durability beyond all expectations.* ◖ Resistance element fused to an enameled metal base. Pure silver floating contact that improves with use, owing to minute silver deposit on the resistance element. ◖ Made with uniform or tapered curve in seven types. $2.40 to $3.50 each.

TRUVOLT Resistances are constructed for air-cooling. This makes for greater durability and satisfaction. The resistance wire is first wound on an asbestos-covered enameled copper core, then this in turn is wound on a grooved, fire-clay base. ◖This means a cooler unit that holds its rated value. ◖The sliding clip—*an exclusive Electrad feature*—permits convenient variation. ◖TRUVOLT Variables have the same superior features as fixed type, with the addition of a handy control knob and variable contact arm for fine adjustment. ◖Due to unique winding, the contact travels endwise over the resistance wire, giving smoother operation with less wear. ◖One-hole mounting, sturdy frame and perforated ventilating shield. ◖Greatly simplifies eliminator construction. 22 stock sizes, $2.50 each.

U. S. Pat. No. 1676869 and Pats. Pend.



TRUVOLT DIVIDER *Universal* Voltage Control

A bank of TRUVOLT Wire-Wound Resistances with five calibrated knobs for controlling the B and C Voltage output from any type eliminator. Accurate voltages are obtained simply by adjusting the knobs from a convenient chart. No complicated calculations. ◖Handsome molded Bakelite case which can be mounted on a sub-panel, or baseboard, or used as a front panel for the eliminator. ◖Especially useful in experimental and laboratory work. $10.00.

175 Varick St., New York, N.Y.

ELECTRAD
INC.

Dept. CR9, 175 Varick St., New York
______ TRUVOLT Resistances
______ Super-TONATROL
______ TRUVOLT Divider

Send Data on Items Checked to
Name ______
Address ______
______

KFOR

1210 kc, Lincoln, Neb., Howard A. Shuman, 100 w, C.

KFOX

1250 kc, Long Beach, Calif., Nichols & Warriner, Inc., 1000 w, P, "Where Your Ship Comes In."

KFPL

1310 kc, Dublin, Texas, C. C. Baxter, 15 w, C, "Baxter's Place."

KFPM

1310 kc, Greenville, Texas, The New Furniture Co., 15 w, C, "Biggest Little Ten Watts on the Air."

KFPW

1340 kc, Siloam Springs, Ark., Rev. Lannie W. Stewart, 50 w, C.

KFPY

1390 kc, Spokane, Wash., Symons Investment Co., 500 w, P.

KFQA

See under KMOX.

KFQD

1230 kc, Anchorage, Alaska, Anchorage Radio Club, 100 w.

KFQU

1420 kc, Holy City, Calif., W. E. Riker, 100 w, P.

KFQW

1420 kc, Seattle, Wash., KFQW, Inc., 100 w, P, "Gateway to Alaska and the Orient."

KFQZ

860 kc, Hollywood, Calif., Taft Radio & Broadcasting Co., Inc., 250 w, P.

KFRC

610 kc, San Francisco, Calif., Don Lee, Inc., 1000 w, P.

KFRU

630 kc, Columbia, Mo., Stephens College, 500 w, C, "Where Friendliness Is Broadcast Daily."

KFSD

600 kc, San Diego, Calif., Airfan Radio Corp., 500 w, P.

KFSG

1120 kc, Los Angeles, Calif., Echo Park Evan. Assn., 500 w, P, "The Church of the Air."

KFUL

1290 kc, Galveston, Texas, W. H. Ford, 1000 w, C, "The City of Perpetual Sunshine."

KFUM

1270 kc, Colorado Springs, Colo., W. D. Corley, 1000 w, M, "Known for Unsurpassed Mountain Scenery."

KFUO

550 kc, St. Louis, Mo., Concordia Theological Seminary, 500 w, C, "The Gospel Voice."

KFUP

1310 kc, Denver, Colo., Fitzsimmons General Hospital, 100 w, M.

KFVD

710 kc, Culver City, Calif., Los Angeles Broadcasting Co., 250 w, P.

KFVS

1210 kc, Cape Girardeau, Mo., Hirsch Battery & Radio Co., 100 w, C, "The City of Opportunity."

KFWB

950 kc, Hollywood, Calif., Warner Bros. Broadcasting, 1000 w, P.

KFWC

1200 kc, Ontario, Calif., J. R. Fouche, 100 w, P, "The Voice of the Orange Empire."

KFWF

1200 kc, St. Louis, Mo., St. Louis Truth Center, Inc., 100 w.

KFWI

930 kc, San Francisco, Calif., Radio Entertainments, Inc., 500 w, P.

KFWM

930 kc, Oakland, Calif., Oakland Educational Society, 500 w, P, "The Most Good to the Most People."

KFXD

1420 kc, Jerome, Idaho, Service Radio Co., 50 w, M.

KFXF

940 kc, Denver, Colo., Pikes Peak Broadcasting Co., 250 w, M, "The Voice of Denver."

KFXJ

1310 kc, Edgewater, Colo., R. G. Howell, 50 w, M, "America's Scenic Center."

KFXR

1310 kc, Oklahoma City, Okla., Exchange Avenue Baptist Church, 100 w, C.

KFXY

1420 kc, Flagstaff, Ariz., Mary M. Costigan, 100 w, M.

KFYO

1420 kc, Abilene, Texas, T. E. Kirksey, 100 w, C, "Breckenridge, the Dynamo of West Texas."

KFYR

550 kc, Bismarck, N. D., Hoskins-Meyer, 500 w, C.

KGA

1470 kc, Spokane, Wash., Northwest Radio Service Co., 5000 w, P.

KGAR

1370 kc, Tucson, Ariz., Tucson Motor Service Co., 100 w, M, "Way Out on the Desert."

KGB

1360 kc, San Diego, Calif., Pickwick Broadcasting Corp., 250 w, P, "Music for the Sick."

KGBU

900 kc, Ketchikan, Alaska, Alaska Radio & Service Co., 500 w. Shared.

KGBX

1370 kc, St. Joseph, Mo., Foster-Hall Tire Co., 100 w.

KGBZ

930 kc, York, Nebr., Geo. R. Miller, 500 w, C, "The Swine and Poultry Station."

KGCA

1270 kc, Decorah, Iowa, Chas. W. Greenley, 50 w, C. Shared.

KGCI

1370 kc, San Antonio, Texas, Liberto Radio Sales, 100 w, C, "Radio Sam at San Antonio."

KGCR

1210 kc, Watertown, S. D., Cutler's Radio Broadcasting Service, Inc., 100 w.

KGCU

1200 kc, Mandan, N. D., Mandan Radio Association, 100 w, M, "The Voice of the West."

KGCX

1420 kc, Vida, Mont., First State Bank of Vida, 10 w, M.

KGDA

1370 kc, Dell Rapids, S. D., Home Auto Co., 50 w.

KGDE

1200 kc, Fergus Falls, Minn., Jaren Drug Co., 50 w, C.

KGDM

1100 kc, Stockton, Calif., E. F. Peffer, 50 w.

KGDR

1500 kc, San Antonio, Texas, KGDR Broadcasting Co., 100 w, C.

KGDY

1200 kc, Oldham, S. Dak., J. Albert Loesch, 15 w, C.

KGEF

1300 kc, Los Angeles, Calif., Trinity Methodist Church, 1000 w, P.

KGEK

1200 kc, Yuma, Colo., Beehler Elec. Equip. Co., 50 w, M. Shared.

KGER

1370 kc, Long Beach, Calif., C. Marwin Dobyns, 100 w, P, "The Service Club of the Air."

KGEW

1200 kc, Ft. Morgan, Colo., City of Ft. Morgan, 100 w, P.

KGEZ

1310 kc, Kalispell, Mont., Chamber of Commerce, 100 w, M, "Located in the Switzerland of America—The Beautiful Flathead Valley."

The First Electric "AC" Radio for $24.00

Never in the history of radio has there been such a startling offer—a well made, long distance "AC" radio for twenty-four dollars. Just what everybody has been waiting for. Every owner of an old style battery set will throw it away and buy. Agents can make more money than they ever dreamed.

Just think—

The very latest in "AC" radio, two stages of SCREEN GRID and yet the price is only $24. Can you imagine how many of these you could sell in the next 30 days.

AGENTS WANTED

No "AC" hum, operates a Dynamic Speaker, has volume and tone to equal any radio—built to give perfect satisfaction and—last. Sales will be entirely through live wire agents who can get the business. It is the opportunity of a lifetime. If you act quick, you can get the exclusive sales in your territory and put hundreds of sub-agents to work for you, but—

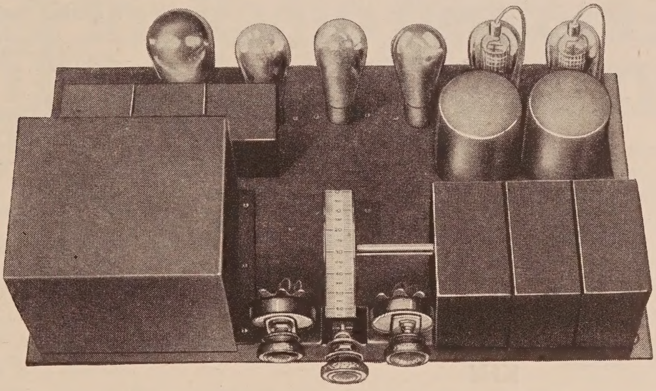
You must act quickly.

Open territories are limited.

EXCLUSIVE TERRITORY

Be in business for yourself—all the profits will be yours. This hum-free, completely shielded, twenty-four dollar set will outsell all others—Today without quitting your present job you can start on the way to a comfortable fortune, by working a few hours each evening. Not a cheap part in the whole set, illuminated single drum dial control. Plug in a socket and demonstrate—when they hear the set and learn the price, it's a sure sale.

Screen Grid



Hum-less

THE NEW ELGIN RADIO

You must act now, write us and we will quickly tell you if your territory is open.

Already many sections of the country have been signed up. It will only cost you a two-cent stamp to find out. We will reveal to you many facts you will find very interesting which we cannot tell you here. Let us know if you are interested.

MAKE $50.00 A WEEK

When you examine the cable wiring, and construction of this set you will agree there is nothing finer and your prospect will appreciate its neat clean-cut appearance.

Forget about college educations, special training and luck. You don't need any of them, just the will to do—demonstrations will make up for lack of experience—two drops of perspiration will equal a ton of inspiration.

SPARE TIME—EVENINGS

Send in the coupon now. Get your set and start on the way to big profits.

ELGIN RADIO CO., 4951 N. Crawford Ave., Chicago, Ill.

Gentlemen—

Kindly let me know immediately if the opportunity of cashing in on the new Elgin Radio is still open in my territory!

NAME...ADDRESS...

KGFF
1420 kc, Alva, Okla., D. R. Wallace, 100 w, C.

KGFG
1370 kc, Oklahoma City, Okla., Faith Tabernacle Assn., 100 w, C, "The Whole Gospel to the Whole World."

KGFI
1500 kc, Corpus Christi, Texas, Eagle Broadcasting Co., 100 w, C, "The Voice of West Texas."

KGFJ
1420 kc, Los Angeles, Calif., Ben S. McGlashan, 100 w, P, "Keeps Good Folks Joyful."

KGFK
1200 kc, Hallock, Minn., R. W. Lautzenheiser, 50 w, C.

KGFL
1370 kc, Raton, N. Mex., Hubbard & Murphy, 50 w, M.

KGFW
1420 kc, Ravenna, Neb., Otto F. Sothman, 50 w.

KGFX
580 kc, Pierre, S. D., Dana McNeil, 200 w, C.

KGGC
1420 kc, San Francisco, Calif., Golden Gate Broadcasting Co., 50 w, P.

KGGF
1010 kc, Picher, Okla., D. L. Connell, M.D., 500 w.

KGGM
1370 kc, Albuquerque, N. Mex., New Mexico Broadcasting Co., 100 w.

KGHF
1320 kc, Pueblo, Colo., Ritchie & Finch, 250 w, M.

KGHG
1310 kc, McGehee, Ark., Chas. W. McCollum, 50 w.

KGHI
1500 kc, Little Rock, Ark., Berean Bible Class, 100 w.

KGHL
950 kc, Billings, Mont., Northwestern Auto Supply Co., 500 w, M.

KGHX
1500 kc, Richmond, Tex., Ft. Bend County School Board, 50 w, C.

KGIQ
1320 kc, Twin Falls, Idaho, Radio Broadcasting Corp., 250 w, M.

KGIR
1360 kc, Butte, Mont., Symons Broadcasting Co., 250 w, M.

KGIW
1420 kc, Trinidad, Colo., Trinidad Creamery Co., 100 w, M.

KGIX
1420 kc, Las Vegas, N. Mex., J. M. Heaton, 100 w.

KGJF
890 kc, Little Rock, Ark., First Church of the Nazarene, 250 w.

KGKB
1500 kc, Brownwood, Tex., Eagle Publ. Co., 100 w, C.

KGKL
1370 kc, San Angelo, Tex., KGKL, Inc., 100 w, C.

KGKO
570 kc, Wichita Falls, Tex., Wichita Falls Broadcasting Co., 250 w, C.

KGKX
1420 kc, Sandpoint, Idaho, C. E. Twiss, 15 w, P.

KGO
790 kc, Oakland, Calif., General Electric Co., 7500 w, P.

KGRC
1370 kc, San Antonio, Texas, Gene Roth & Co., 100 w, C.

KGRS
1410 kc, Amarillo, Texas, Gish Radio Service, 1000 w, C. Shared.

KGU
940 kc, Honolulu, Hawaii, Marion Mulrony, 500 w, "In the Land of Sunshine, the Future Playground of America."

KGW
620 kc, Portland, Ore., Oregonian Pub. Co., 1000 w, P, "Keep Growing Wiser."

KGY
1200 kc, Lacey, Wash., St. Martins College, 10 w, P, "Out Where the Cedars Meet the Sea." Shared.

KHJ
900 kc, Los Angeles, Calif., Don Lee, Inc., 1000 w, P, "Kindness, Happiness, Joy."

KHQ
590 kc, Spokane, Wash., Louis Wasmer, Inc., 1000 w, P, "In the Friendly City."

KICK
1420 kc, Red Oak, Iowa, Red Oak Radio Corp., 100 w.

KID
1320 kc, Idaho Falls, Ida., Jack W. Duckworth, Jr., 250 w, M.

KIDO
1250 kc, Boise, Idaho, F. L. Hill & C. G. Phillips, 1000 w, P.

KIT
1370 kc, Yakima, Wash., C. E. Haymond, 50 w, P.

KJBS
1070 kc, San Francisco, Calif., Julius Brunton & Sons Co., 100 w, P, "The Voice of the Storage Battery."

KJR
970 kc, Seattle, Wash., Northwest Radio Service Co., 5000 w, P.

KLCN
1290 kc, Blytheville, Ark., C. L. Lintzenich, 50 w, C.

KLO
1370 kc, Ogden, Utah, Peery Building Co.,100 w, M.

KLRA
1390 kc, Little Rock, Ark., Arkansas Broadcasting Co., 1000 w.

KLS
1440 kc, Oakland, Calif., Warner Bros., 250 w, P, "The City of Golden Opportunity."

KLX
880 kc, Oakland, Calif., Tribune Pub. Co., 500 w, P, "Where Rail and Water Meet."

KLZ
560 kc, Dupont, Colo., Reynolds Radio Co., Inc., 1000 w, M, "The Pioneer Station of the West."

KMA
930 kc, Shenandoah, Iowa, May Seed & Nursery Co., 500 w, C, "Keeps Millions Advised."

KMBC
950 kc, Independence, Mo., Midland Broadcasting Co., 1000 w, C, "The Station Dedicated to Knowledge, Liberty, Divinity and Service."

KMED
1310 kc, Medford, Ore., Mrs. W. J. Virgin, 50 w, P, 'See Crater Lake."

KMIC
1120 kc, Inglewood, Calif., Dalton's, Inc., 500 w, P.

KMJ
1200 kc, Fresno, Calif., The Fresno Bee, 100 w, P.

KMMJ
740 kc, Clay Center, Neb., The M. M. Johnson Co., 1000 w, C, The Old Trusty Station."

KMO
1340 kc, Tacoma, Wash., KMO, Inc., 500 w, P.

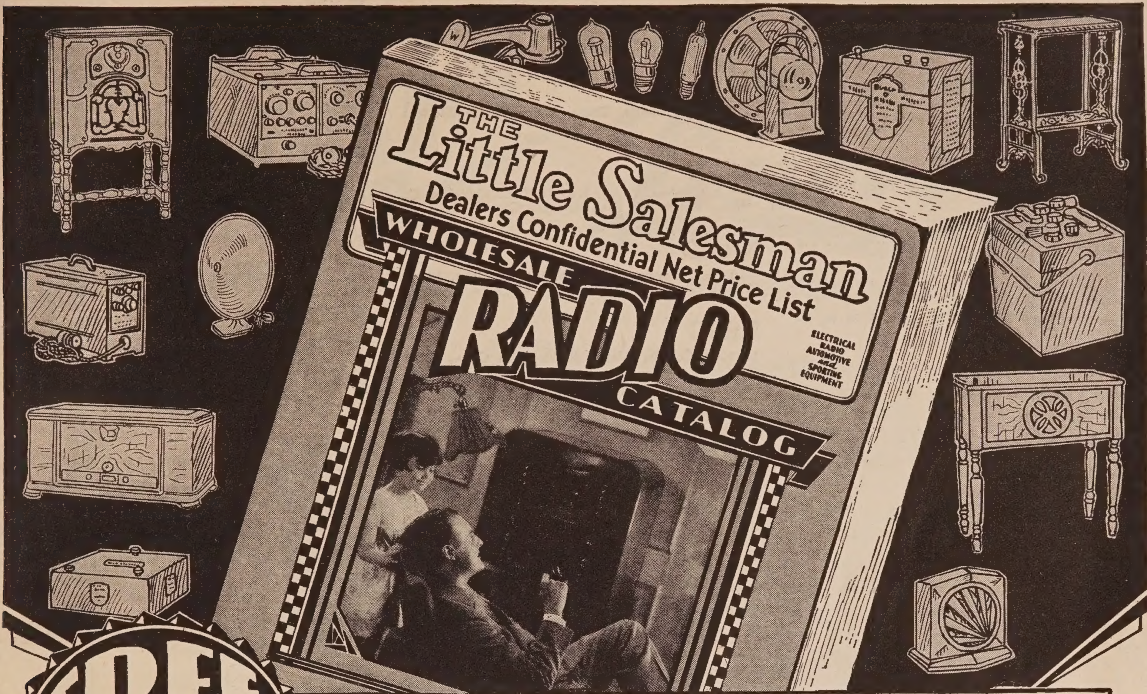
KMOX
1090 kc, St. Louis, Mo., Voice of St. Louis, Inc., 5000 w, C.

KMTR
570 kc, Hollywood, Calif., KMTR Radio Corp., 1000 w, P, "Your Friend in Hollywood."

KNX
1050 kc, Hollywood, Calif., Western Broadcast Co., 5000 w, P, "The Voice of Hollywood."

KOA
830 kc, Denver, Colo., General Electric Co., 12,500 w, M.

KOAC
560 kc, Corvallis, Ore., Oregon State Agricultural College, 1000 w, P, 'Science for Service."



FREE Money Saving RADIO catalog

for Radio Dealers, Agents, Set Builders and Service Men

NEW England Mills offers everything in radio at wholesale prices that spell real savings! That's what you will find in this great catalog just off the press, featuring Radio's newest creations in sets, kits, parts and supplies. Everything in our catalog is backed by the guarantee of this old, stable concern and its vast resources, accumulated through 17 years of faithful service to customers.

Why Our Prices Are Low

We are one of the largest outlets by mail to the trade. Our connections with many of America's leading factories enables us to buy on our own terms. Our cash resources makes it possible to command the very lowest prices from manufacturers—in most cases merely a small margin above the actual manufacturing cost—and frequently at lower than cost. This in turn is reflected in the net **wholesale prices** we show in our catalog. We give our customers the benefit of our vast purchasing power.

All Radio Dealers Save Money

by trading with New England Mills. This saving applies to complete radio sets of every description, dynamic and magnetic speakers, A. C. and all other types of tubes, eliminators, batteries, radio cabinets —in fact, everything required by dealers for resale or servicing. Every dealer knows that by buying right he is in position to sell at **prices that meet all kinds of competition,** thereby increasing his profits and good-will.

Set Builders and Repair Men

A tremendous amount of business will be done this season in rebuilding sets which users want to keep, and by modernizing old models. Our catalog contains everything required for this work. Besides, we have a supply of the **latest models of nationally renowned kits**—either knocked down or completely assembled chassis ready to install in table or console cabinets, all at **wholesale prices** that permit of excellent profits to you.

Catalog also contains complete lines of Electrical Goods, Tires, Tubes and Auto Supplies. All kinds of Sporting Goods and hundreds of other items at wholesale prices.

NEW ENGLAND MILLS COMPANY
851 Washington Blvd. Dept. 20 Chicago, Ill.

A. C. Electric Radios

Our new catalog contains a large selection of the finest A. C. Electric, 6, 7, 8 and 9 tube chassis and complete sets obtainable at the amazingly low prices we quote. Every modern radio improvement is embodied in these **marvelous electric radios.** All are sold by us with the **guarantee of satisfaction** backed by this 17-year-old institution.

Battery Sets for Unwired Homes

The vast number of rural communities with homes that are not wired for electric radios offer a tremendous market for battery sets, repairs and replacements. We have not overlooked this important field, as evidenced by the **large stock of batteries, eliminators, speakers, tubes, transformers, coils,** and all kinds of accessories needed for battery sets. These supplies include some of the **best known nationally advertised goods,** such as **Cunningham, Sonatron** and **Arcturus tubes, Burgess batteries, Jewel instruments, Belden Products, Utah, Temple, Farrand** and other popular **dynamic** and **magnetic speakers.**

Send for Free Book—NOW!

Radio dealers, agents, set builders, service men, etc., cannot afford to be without the New England Mills catalog. It contains everything you need for a more profitable radio business. We maintain a complete radio service department, supervised by expert radio engineers who will help you with all your radio problems. All goods cataloged are stocked for immediate shipment. Write for this book today. It is FREE!

Send your request for catalog on your business stationery.

RADIO SETS
RADIO ACCESSORIES
THE NEW ENGLAND

KOB

1180 kc, State College, N. M., N. M. College of Agri. & Mech. Arts, 10,000 w, M, "The Sunshine State of America."

KOCW

1400 kc, Chickasha, Okla., Oklahoma College for Women, 250 w, C.

KOH

1370 kc, Reno, Nevada, Jay Peters, Inc., 100 w.

KOIL

1260 kc, Council Bluffs, Iowa, Mona Motor Oil Co., 1000 w, C, "The Hilltop Studio."

KOIN

940 kc, Portland, Ore., KOIN, Inc., 1000 w, P, "The Station of the Hour."

KOL

1270 kc, Seattle, Wash., Seattle Broadcasting Co., 1000 w, P.

KOMO

920 kc, Seattle, Wash., Fisher's Blend Station, Inc., 1000 w, P.

KOOS

1370 kc, Marshfield, Ore., H. H. Hanseth, 50 w, P.

KORE

1420 kc, Eugene, Ore., Eugene Broadcast Station, 100 w, P.

KOY

1390 kc, Phoenix, Ariz., Nielsen Radio Supply Co., 500 w, M, "Kind Friends Come Back."

KPCB

1210 kc, Seattle, Wash., Pacific Coast Biscuit Co., 50 w, P. Shared.

KPJM

1500 kc, Prescott, Ariz., Miller & Klahn, 100 w, M.

KPLA

1000 kc, Los Angeles, Calif., Pacific Development Radio Co., 1000 w, P.

KPO

680 kc, San Francisco, Calif., Hale Bros. & The Chronicle, 5000 w, P, "The City of the Golden Gate."

KPOF

880 kc, Denver, Colo., Pillar of Fire, Inc., 500 w, M.

KPPC

1200 kc, Pasadena, Calif., Pasadena Presbyterian Church, 50 w, P.

KPQ

1210 kc, Seattle, Wash., Taft & Wasmer, Inc., 100 w, P.

KPRC

920 kc, Houston, Texas, Houston Printing Co., 1000 w, C, "Kotton Port Rail Center."

KPSN

950 kc, Pasadena, Calif., Pasadena Star-News, 1000 w, P.

KPWF

1490 kc, Westminster, Calif., Pacific Western Broadcasting Federation, 5,000 w, P.

KQV

1380 kc, Pittsburgh, Pa., Doubleday-Hill Elec. Co., 500 w, E, "The Smoky City Station."

KQW

1010 kc, San Jose, Calif., First Baptist Church, 500 w, P, "For God and Country."

KRE

1370 kc, Berkeley, Calif., First Congregational Church, 100 w, P.

KRGV

1260 kc, Harlingen, Texas, Valley Radio Electric Corp., 500 w.

KRLD

1040 kc, Dallas, Texas, KRLD, Inc., 10,000 w, C, "Down Where the Blue Bonnets Grow."

KRMD

1310 kc, Shreveport, La., Robert M. Dean, 50 w, C.

KRSC

1120 kc, Seattle, Wash., Radio Sales Corp., 50 w P.

KSAC

580 kc, Manhattan, Kan., Kansas State Agricultural College, 500 w, C.

KSCJ

1330 kc, Sioux City, Iowa, Perkins Bros. Co., 1000 w, C.

KSD

550 kc, St. Louis, Mo., Pulitzer Pub. Co., 500 w, C.

KSEI

900 kc, Pocatello, Idaho, KSEI Broadcasting Assn., 250 w, M, "Kummunity Southeast Idaho."

KSL

1130 kc, Salt Lake City, Utah, Radio Service Corp., 5000 w, M, "The Voice of the Intermountain Empire."

KSMR

1200 kc, Santa Maria, Calif., Santa Maria Valley R. R. Co., 100 w, P, "The Valley of Gardens."

KSO

1380 kc, Clarinda, Iowa, Berry Seed Co., 500 w, C, "Keep Serving Others."

KSOO

1110 kc, Sioux Falls, S. D., Sioux Falls Broadcasting Assn., 1000 w, C.

KSTP

1460 kc, St. Paul, Minn., National Battery Broadcasting Co., 10,000 w, C.

KTAB

550 kc, Oakland, Calif., Associated Broadcasters, 500 w, P, "Knowledge, Truth and Beauty."

KTAP

1420 kc, San Antonio, Texas, Alamo Broadcasting Co., 100 w, C, "The World's Biggest Little Station."

KTAT

1240 kc, Ft. Worth, Texas, Texas Air Transport Broadcasting Co., 1000 w, C.

KTBI

1300 kc, Los Angeles, Calif., Bible Institute of Los Angeles, 750 w, P.

KTBR

1300 kc, Portland, Ore., M. E. Brown, 500 w, P.

KTHS

1040 kc, Hot Springs, Ark., Chamber of Commerce, 10,000 w, C, "Kum to Hot Springs."

KTM

780 kc, Santa Monica, Calif., Pickwick Broadcasting Corp., 500 w, P, "The Station with a Smile."

KTNT

1170 kc, Muscatine, Iowa, Norman Baker, 5000 w C, "The Voice of the Iowa Farmers' Union."

KTSA

1290 kc, San Antonio, Texas, Lone Star Broadcast Co., 1000 w, C.

KTSL

1310 kc, Shreveport, La., Houseman Sheet Metal Works, Inc., 100 w, C.

KTUE

1420 kc, Houston, Texas, Uhalt Electric, 100 w, C.

KTW

1270 kc, Seattle, Wash., First Presbyterian Church, 1000 w, P.

KUJ

1500 kc, Longview, Wash., F. W. Lovejoy & R. W. Kerfoot, 10 w, P.

KUOA

1390 kc, Fayetteville, Ark., University of Arkansas, 1000 w, C.

KUOM

570 kc, Missoula, Mont., State University of Montana, 500 w, M.

KUSD

890 kc, Vermilion, S. Dak., University of South Dakota, 500 w, C.

KUT

1120 kc, Austin, Texas, Kut Broadcasting Co., 500 w, C, "Come to University of Texas."

KVI

760 kc, Tacoma, Wash., Puget Sound Radio Broadcasting Co., 1000 w, P, "Puget Sound Station."

KVL

1370 kc, Seattle, Wash., Arthur C. Bailey, 100 w.

KVOA

1260 kc, Tuscon, Ariz., R. M. Riculfi, 500 w.

KVOO

1140 kc, Tulsa, Okla., Southwestern Sales Corp., 5000 w, C, "The Voice of Oklahoma."

KVOS

1200 kc, Bellingham, Wash.. KVOS, Inc., 100 w, M.

KWBS

1500 kc, Portland, Ore., Schaeffer Radio Co., 15 w, P.

KWCR

1310 kc, Cedar Rapids, Iowa, Harry F. Paar, 100 w.

KWEA

1210 kc, Shreveport, La., William E. Antony, 100 w, C.

KWG

1200 kc, Stockton, Calif., Portable Wireless Tel. Co., 100 w, P.

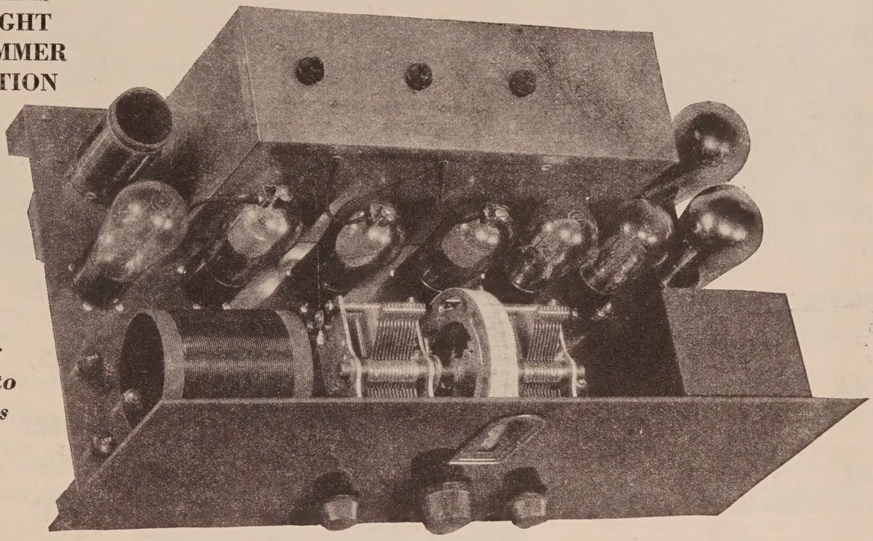
KWJJ

1060 kc, Portland, Ore., Wilbur Jerman, 500 w, P. "The Voice from Broadway."

AGAIN LINCOLN SETS THE PACE WITH THE *Lincoln* 8-40

THE GREATEST ENGINEERED SCREEN GRID SUPER IN RADIO HISTORY

**800 MILES
DAYLIGHT
MID-SUMMER
RECEPTION**



Every frequency from 180 to 550 meters

NO HIGH PRICED POWER PACK REQUIRED—Operate this high powered Super on a small "B" supply only—*No other equipment necessary.*

MARVELOUS TONE—Heavy register on low musical frequencies.

ONE SPOT—Absolutely no interference from a single harmonic.

A New I.F. Amplifier

Covering a period of six months of intensive study of high screen grid amplification, Lincoln engineering has produced the highest gain I.F. transformers known, with tremendous high gain perfectly controlled without oscillation at any amount of power.

One noted Radio Engineer states: "I have tested every make of modern intermediate transformer and could not believe my findings of the I.F. transformers in the Lincoln 8-40 when my test showed over three times the gain over all other makes."

TUNABLE STAGES so operative that a slight movement of one control will tune out your local station (read the reason in article in this issue), producing extreme selectivity which causes stations to actually explode in as dial passes frequency. THIS MEANS RECEPTION YOU HAVE NEVER DREAMED OF.

LINCOLN SUPERS have never been sold on high pressure advertising. We could have headlined many reports of consistent reception from stations in Europe, Japan, Australia and other foreign countries. We could tell you of customers who were dissatisfied because they could not get three 10 KC bands, when every other channel came in perfect, in the whole broadcast band from 200 to 545 meters.

Set Builders remember LINCOLN performance means repeat sales for you.

Write at once for complete information on the greatest receiver ever developed, and give qualifications for selling this equipment in your territory.

LINCOLN RADIO CORPORATION
329 SOUTH WOOD ST. — CHICAGO • ILLINOIS.

Factory Representatives
Australia—New Zealand—Union of South Africa

JENTS, YORE & WHITEHOUSE
46-48-50 Haig Street
Melbourne, Australia

LINCOLN RADIO CORP., Dept. C
329 S. Wood St., Chicago
Send full information on the Lincoln 8-40.

Name..

Address..

....

Western Representatives
LINCOLN RADIO SALES AGENCY
200 Davis Street
San Francisco, California

KWK

1350 kc, St. Louis, Mo., Greater St. Louis Broadcasting Corp., 1000 w, C.

KWKC

1370 kc, Kansas City, Mo., Wilson Duncan Broadcasting Co., 100 w.

KWKH

850 kc, Kennonwood, La., W. K. Henderson, 5000 w, C.

KWLC

1270 kc, Decorah, Iowa, Luther College, 100 w, C.

KWSC

1390 kc, Pullman, Wash., State College of Washington, 500 w, P, "The Voice of the Cougars."

KWTC

1500 kc, Santa Ana, Calif., Pacific Western Broadcasting Fed., 100 w, P, "Kum West to California."

KWWG

1260 kc, Brownsville, Texas, Chamber of Commerce, 500 w, C, "Good Night, World."

KWYO

600 kc, Laramie, Wyo., Bishop N. S. Thomas, 500 w, M, "The Top of the World."

KXA

570 kc, Seattle, Wash., American Radio Tel. Co., 500 w, P.

KXL

1250 kc, Portland, Ore., KXL Broadcasters, Inc., 500 w, P, "The Voice of Portland."

KXO

1200 kc, El Centro, Calif., Irey & Bowles, 100 w, P.

KXRO

1420 kc, Aberdeen, Wash., KXRO, Inc., 75 w.

KYA

1230 kc, San Francisco, Calif., Pacific Broadcasting Corp., 1000 w, P.

KYW

1020 kc, Chicago, Ill., Westinghouse E. & M. Co., 5000 w, C.

KYWA

1020 kc, Chicago, Ill., Westinghouse Elec. & Mfg. Co., 500 w, C.

KZM

1370 kc, Hayward, Calif., Leon P. Tenney, 100 w, P.

NAA

690 kc, 434.5 m, United States Navy Department, Washington, D. C., 1000 w, "Where the Time Signals Originate," E.

WAAF

920 kc, Chicago, Ill., Drovers Journal Pub. Co., 500 w daytime, C.

WAAM

1250 kc, Newark, N. J., WAAM, Inc., 1000 w, E, "Sunshine Station."

WAAT

1070 kc, Jersey City, N. J., Bremer Broadcasting Corp., 300 w.

WAAW

660 kc, Omaha, Neb., Omaha Grain Exchange, 500 w daytime, C, "Pioneer Market Station of the West."

WABC

860 kc, New York City, N. Y., Atlantic Broadcasting Corp., 5000 w, E.

WABI

1200 kc, Bangor, Maine, First Universalist Church, 100 w, E, "The Pine Tree Wave."

WABO

See under WHEC.

WABZ

1200 kc, New Orleans, La., Coliseum Place Baptist Church, 100 w, C.

WADC

1320 kc, Akron, Ohio, Allen T. Simmons, 1000 w E, shared, "Watch Akron Develop Commercially."

WAFD

1500 kc, Detroit, Mich., Albert B. Parfet Co., 100 w, E.

WAGM

1310 kc, Royal Oak, Mich., Robert L. Miller, 50 w, E.

WAIU

640 kc, Columbus, Ohio, American Insurance Union, 500 w, E, "The Radio Voice of the American Insurance Union."

WAPI

1140 kc, Birmingham, Ala., Alabama Polytechnic Institute, 5000 w, C.

WASH

1270 kc, Grand Rapids, Mich., Baxter Laundries, Inc., 250 w, C.

WBAK

1430 kc, Harrisburg, Pa., Pennsylvania State Police, 500 w, E, "The Voice of Pennsylvania."

WBAL

1060 kc, Baltimore, Md., Consolidated Gas, Elec. Co., 10,000 w, E, "The Station of Good Music."

WBAP

800 kc, Ft. Worth, Tex., Carter Publications, Inc., 50,000 w, C.

WBAW

1490 kc, Nashville, Tenn., Tennessee Publishing Co., 5000 w, C.

WBAX

1210 kc, Wilkes-Barre, Pa., John H. Stenger, Jr., 100 w, E, "In Wyoming Valley, Home of the Anthracite."

WBBC

1400 kc, Brooklyn, N. Y., Brooklyn Broadcasting Corp., 500 w.

WBBL

1370 kc, Richmond, Va., Grace Covenant Presbyterian Church, 100 w, E, "Richmond, the Gateway North and South."

WBBM

770 kc, Chicago, Ill., Atlas Investment Co., 10,000 w, C.

WBBR

1300 kc, Rossville, N. Y., People's Pulpit Association, 1000 w, E, "Watch Tower."

WBBY

1200 kc, Charleston, S. C., Washington Light Infantry, 75 w, E, "The Seaport of the Southeast."

WBBZ

1200 kc, Ponca City, Okla., C. L. Carrell, 100 w, C.

WBCM

1410 kc, Bay City, Mich., James E. Davidson, 500 w, E, "Where the Summer Trail Begins."

WBCN

See under WENR.

WBIS

See under WNAC.

WBMS

1450 kc, Fort Lee, N. J., WBMS Broadcasting Corp., 250 w.

WBNY

1350 kc, New York, N. Y., Baruchrome Corp., 250 w, E, "The Voice of the Heart of New York."

WBOQ

See under WABC.

WBOW

1310 kc, Terre Haute, Ind., Banks of Wabash Broadcasting Assn., 100 w, C, "On the Banks of the Wabash."

WBRC

930 kc, Birmingham, Ala., Birmingham Broadcasting Co., 500 w, C, "The Biggest Little Station in the World."

WBRE

1310 kc, Wilkes-Barre, Pa., Louis G. Baltimore, 100 w, E.

WBRL

1430 kc, Tilton, N. H., Booth Radio Laboratories, 500 w, E.

WBSO

780 kc, Wellesley Hills, Mass., Babson's Statistical Org., Inc., 250 w, E.

WBT

1080 kc, Charlotte, N. C., C. C. Coddington, 5000 w, E, shared, "The Queen City of the South."

WBZ

990 kc, Springfield, Mass., Westinghouse E. & M. Co., 15,000 w, E, "The Broadcasting Station of New England."

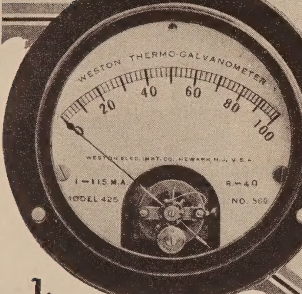
4 ways to insure best Results

1. *3¼" diameter panel—D. C., A. C. and thermo-couple instruments for the dealer or anyone who is building up panel test equipment.*

2. *A. C. Model 528 Portable Ammeters and Voltmeters.*
Adapted especially for testing A. C. operated radio sets. Alike in size and shape to its companion D. C. instrument (Model 489). Pair of 30" cables supplied with voltmeters.

3. *Model 547 Radio Set Tester.*
A. C. Voltmeter—750/150/16/8/4 volts. D. C. Voltmeter. High range increased to 750 volts. Other ranges 250/100/50/10/5 volts D. C. Milliammeter double-range—100/20 M. A.

4. *Model 533 Counter Tube Checker.*
Requires no batteries, operates direct from any A. C. light socket or any other A. C.-60 cycle—90 to 130 volts source of supply. Will test every type of tube, A. C. or D. C. having filament voltages of 1.5, 2.5, 3.3, 5 or 7.5 volts, including rectifying type tubes.


WESTON THERMO-GALVANOMETER
20
40
60
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100
WESTON ELEC. INST. CO. NEWARK, N.J. U.S.A.
1-115 M.A.
R-4Ω
MODEL 425
NO. 560

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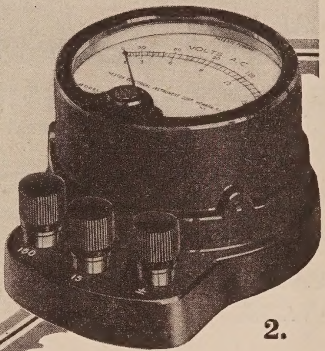

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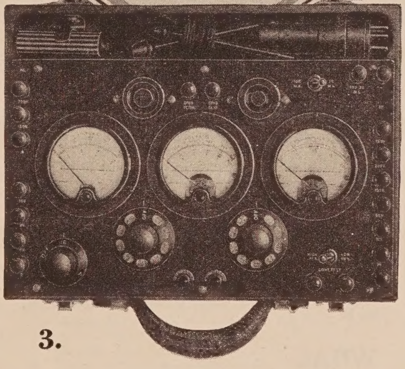

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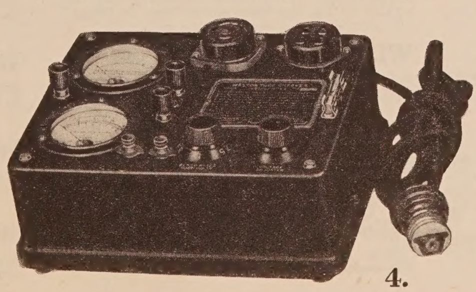


4.

Testing Equipment That Assures Reliability

Weston instruments, the standard of the world, emphasize the fact that reliability pays dividends. Forty-one years of constant effort to improve and perfect the art of electrical measurement has resulted in the production of instruments upon which dealers, service men and set owners can depend to protect their financial investments.

The supreme test of every radio receiver comes after the installation is completed—but continuous and satisfactory operation can be assured by making careful tests with reliable instruments both before and after the sale.

The use of Weston instruments by the dealer and service man instils confidence and makes every purchaser a booster. To the set owner, frequent checking with Weston instruments insures lowest maintenance cost, highest operating efficiency and fullest satisfaction from the radio receiver.

A Vital Part of Every Radio Installation

The Model 547 Radio Set Tester, for instance, not only locates "shorts" between grid and plate, but also discovers distortion in the audio system due to tube overloading. It also provides for filament circuit and general continuity tests and serves as a rapid tube checker.

The counter tube checker—Model 533—makes it possible to obtain with great speed the proper voltage regulation, by means of a voltage adjusting dial and voltage indicator.

The A. C. and 3-range voltmeters, like all Weston instruments, command the attention of all who appreciate the finest workmanship and demand unfailing reliability.

Weston instruments absolutely eliminate all guess work. They give the service man an immediate and accurate answer to every question he may ask, enabling him to diagnose quickly and surely every trouble.

Each instrument is handsome in appearance, light but rugged, made for long service and unfailing dependability. They will increase your profits.

Weston
PIONEERS
SINCE 1888
INSTRUMENTS

WESTON ELECTRICAL INSTRUMENT CORP.
574 Frelinghuysen Avenue
Newark, New Jersey

WBZA

990 kc, Boston, Mass., Westinghouse E. & M. Co., 500 w, E.

WCAC

600 kc, Storrs, Conn., Connecticut Agricultural College, 250 w, E, "Voice from the Nutmeg State."

WCAD

1220 kc, Canton, N. Y., St. Lawrence University, 500 w, E, "The Voice of the North Country."

WCAE

1220 kc, Pittsburgh, Pa., Kaufman & Baer Co. 500 w, E, "Where Prosperity Begins."

WCAH

1430 kc, Columbus, Ohio, Commercial Radio Service Co., 500 w, E.

WCAJ

590 kc, Lincoln, Neb., Nebraska Wesleyan University, 500 w, C.

WCAL

1250 kc, Northfield, Minn., St. Olaf College, 1000 w, C, "The College on the Hill."

WCAM

1280 kc, Camden, N. J., City of Camden, 500 w, E.

WCAO

600 kc, Baltimore, Md., Monumental Radio, Inc., 250 w, E, "The Gateway of the South."

WCAP

1280 kc, Asbury Park, N. J., Radio Industries Broadcast Co., 500 w, E.

WCAT

1200 kc, Rapid City, S. D., South Dakota State School of Mines, 100 w, M.

WCAU

1170 kc, Philadelphia, Pa., Universal Broadcasting Co., 10,000 w, E, "Where Cheer Awaits U."

WCAZ

1070 kc, Carthage, Ill., Carthage College, 100 w.

WCBA

1440 kc, Allentown, Pa., B. B. Musselman, 250 w, E.

WCBD

1080 kc, Zion, Ill., Wilbur Glen Voliva, 5000 w, C.

WCBM

1370 kc, Baltimore, Md., Baltimore Broadcasting Corp., 100 w, E.

WCBS

1210 kc, Springfield, Ill., Dewing & Meester, 100 w, C.

WCCO

810 kc, Minneapolis, Minn., Washburn-Crosby Co., 15,000 w, C, "Service to the Northwest."

WCDA

1350 kc, New York, N. Y., Italian Educational Broadcasting Co., 250 w, E.

WCFL

970 kc, Chicago, Ill., Chicago Federation of Labor, 1500 w, C, "The Voice of Labor."

WCGU

1400 kc, Coney Island, N. Y., U. S. Broadcasting Corp, 500 w, E.

WCKY

1480 kc, Covington, Ky., L. B. Wilson, 5000 w, E.

WCLB

1500 kc, Long Beach, N. Y., Arthur Faske, 100 w, E, "The Voice of Community Service."

WCLO

1200 kc, Kenosha, Wis., C. Whitmore, 100 w, C.

WCLS

1310 kc, Joliet, Ill., WCLS, Inc., 100 w, C.

WCMA

1400 kc, Culver, Ind., Culver Military Academy, 500 w, C, "The Voice of Culver."

WCOA

1120 kc, Pensacola, Fla., City of Pensacola, 500 w, E, "Wonderful City of Advantages."

WCOC

880 kc, Columbus, Miss., Crystal Oil Co., 500 w, C.

WCOH

1210 kc, Yonkers, N. Y., Westchester Broadcasting Corp., 100 w, E.

WCRW

1210 kc, Chicago, Ill., Clinton R. White, 100 w, C.

WCSH

940 kc, Portland, Me., Congress Square Hotel Co., 500 w, E, "The Voice From Sunrise Land."

WCSO

1380 kc, Springfield, Ohio, Wittenberg College, 500 w, E.

WDAE

620 kc, Tampa, Fla., Tampa Publishing Co., 1000 w, E, "WDAE, the Voice of the Times at Tampa."

WDAF

610 kc, Kansas City, Mo., Kansas City Star Co., 1000 w, C, "Enemies of Sleep."

WDAG

1410 kc, Amarillo, Texas, National Radio & Broadcasting Corp., 250 w, C, "Where Dollars Always Grow."

WDAH

1310 kc, El Paso, Texas, Trinity Methodist Church, 100 w, M.

WDAY

1280 kc, Fargo, N. D., WDAY, Inc., 1000 w, C.

WDBJ

930 kc, Roanoke, Va., Richardson-Wayland Elec. Corp., 250 w, E, "The Magic City."

WDBO

620 kc, Orlando, Fla., Rollins College, Inc., 1000 w, E, "Down Where the Oranges Grow."

WDEL

1120 kc, Wilmington, Del., WDEL, Inc., 250 w, E, "First City of the First State."

WDGY

1180 kc, Minneapolis, Minn., Dr. Geo. W. Young, 1000 w, C.

WDOD

1280 kc, Chattanooga, Tenn., Chattanooga Radio Co., Inc., 500 w, C.

WDRC

1330 kc, New Haven, Conn., Doolittle Radio Corp., 500 w, E.

WDSU

1270 kc, New Orleans, La., Jos. H. Uhalt, 1000 w, C.

WDWF

1210 kc, Providence, R. I., Dutee W. Flint, 100 w, E.

WDZ

1070 kc, Tuscola, Ill., James L. Bush, 100 w.

WEAF

660 kc, New York, N. Y., National Broadcasting Co., Inc., 50,000, w, E.

WEAI

1270 kc, Ithaca, N. Y., Cornell Univ., 500 w, E.

WEAN

550 kc, Providence, R. I., The Shepard Stores Co., 250 w, E, "We Entertain a Nation."

WEAO

550 kc, Columbus, Ohio, Ohio State University, 750 w, E.

WEAR

1070 kc, Cleveland, Ohio, WTAM and WEAR, Inc., 1000 w, E.

WEBC

1280 kc, Duluth, Minn., Head of The Lakes Broadcasting Co., 1000 w, C.

WEBE

1210 kc, Cambridge, Ohio, Roy W. Waller, 100 w, E.

WEBQ

1210 kc, Harrisburg, Ill., First Trust & Savings Bank, 100 w, C.

WEBR

1310 kc, Buffalo, N. Y., Howell Broadcasting Co., 100 w, E, "We Extend Buffalo's Regards."

WEBW

600 kc, Beloit, Wis., Beloit College, 350 w, C,

WEDC

1210 kc, Chicago, Ill., Emil Denemark, Inc., 100 w.

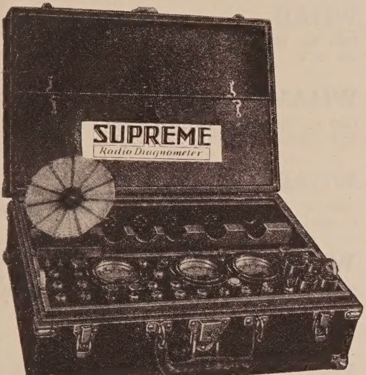
WEDH

1420 kc, Erie, Pa., Erie Dispatch-Herald, 30 w, E.

An Eye-Opener !!

No further proof required! Every Service Man and Dealer MUST be equipped with SUPREME DIAGNOMETER Model 400-B if he is to profitably solve every radio service problem. No other testing device or equipment on the market approaches the great range and flexibility of this *complete, portable, simplified radio-laboratory* . . . . . in a carrying case providing compartments for all necessary tools, adapters, tubes and accessories.

The greatest medium available for producing service profits—creating good will—and increasing sales of receiving sets!



Order Now to Assure Fall Delivery

FOLLOWING the enthusiastic reception given SUPREME DIAGNOMETER Model 400-B, at its initial showing at the Chicago RMA Show, dealers everywhere are placing orders in such volume as to prohibit promises of immediate deliveries.

PLACE YOUR ORDER NOW! Orders will be accepted for future delivery on specified dates against which reservations will be made that will insure delivery on desired date. Make use of this plan to avoid later disappointments.

SUPREME INSTRUMENT CORP.,
336 Supreme Bldg., Greenwood, Miss.

Please ship..................SUPREME DIAGNOMETER Model 400-B, on the basis checked below:

Net Cash—$139.50 F. O. B. Greenwood, Miss.

Time-Payment Plan—$33.50 Cash and 8 monthly payments of $15.00 each F. O. B. Greenwood, Miss. (No dealers' discounts.)

Date of shipment..
Signed..
Firm name..
Street address..
City..............................State..................
REFERENCES:
Name..
Address..
Name..
Address..
Name..
Address..
DISTRIBUTOR:
Name..
Address..

Most good distributors carry the SUPREME DIAGNOMETER in stock. If your distributor cannot supply you, send your order direct on order form above.

Convincing Comparison

Following is comparison of the Supreme Diagnometer with the three leading set testers, which are designated "A," "B" and "C," and the most popular test board on the market, which sells for more than double the price of the Supreme Diagnometer. "X" indicates **YES.** Blank space indicates **NO.**

Tests, Functions and Facilities	Set Tester "A"	Set Tester "B"	Supreme Diag-nometer	Set Tester "C"	Test Board
D. C. Filament Voltage Reading	X	X	X	X	X
A. C. Filament Voltage Reading	X	X	X	X	X
Plate Voltage Reading	X	X	X	X	X
Plate Current Reading	X	X	X	X	X
Simultaneous Plate Current and Voltage Readings	X		X	X	X
Grid Voltage Reading	X	X	X	X	X
Cathode Bias Reading	X	X	X	X	X
Screen Grid Voltage	X	X	X	X	X
Control Grid Voltage	X	X	X	X	X
Analysis Without Use of Adapter	X	X	X	X	X
Line Voltage Reading	X	X	X		X
Locate Unbalanced Secondaries	X		X		
Reads Both Positive and Negative Cathode Biasing			X		
Oscillation Test of Tubes			X		
A. C. Line Tube Testing			X		
Bias Emission Tube Tester			X		
Tests 15 Volt Filament Tubes Independent of Radio			X		
Tests Screen Grid Tubes Independent of Radio			X		
Tests Overhead Filament Type Tubes Independent of Radio			X		
Tests Both Plates '80 Type Tubes			X		
Rejuvenates Thoriated Filament Tubes Out of Set			X		
Without Removing from Set			X		
D. C. Continuity Tester Without Batteries			X		
Furnishes Modulated Signal for Testing			X		
Synchronizing—					
By Thermal—Meter Method			X		
B. A. C. Meter Method			X		
By Audible Method			X		
Neutralizing Signals Provided			X		
Thermo—Couple Movement Meter			X		
Tests Gain of Audio Amplifiers			X		
Measures Up to 250 Mils. A. C. Current			X		
External Uses of Meters	X	X	X	X	X
Of 750 D. C. Meter	X		X		X
Of 750 A. C. Meter	X		X		X
Of 2.5 Amps. Milliammeter			X		
Measures Capacity of Condensers .01 to 9. Mfd.	X		X		X
Tests Charger Output by Meter			X		
Bridges Open of Audio Stages for Tests			X		
Positive Milliammeter Protection for Tube Testing			X		
500,000 Ohm Variable Resistor for Testing			X		
30 Ohm Rheostat for Testing			X		
Self-Contained Power Plant for All Required Tests			X		
Percentage of EFFICIENCY	38 %	26 %	100 %	26 %	36 %

In addition to the foregoing, the **"SUPREME DIAGNOMETER,"** through its multiplicity of circuits, provides innumerable combinations of value in servicing and analysis work. More than a set tester or test board—a complete laboratory in portable, convenient form at a surprisingly low price. The greatest aid to the radio industry yet developed.

SUPREME
Radio Diagnometer

Makes every conceivable test on any Radio Set-

WEEI
590 kc, Boston, Mass., Edison Elec. Illum. Co., 500 w, E, "The Friendly Voice."

WEHS
1310 kc, Evanston, Ill., Victor C. Carlson, 100 w, C.

WELK
1370 kc, Philadelphia, Pa., Howard R. Miller, 100, E.

WEMC
590 kc, Berrien Springs, Mich., Emmanuel Missionary College, 1000 w, C, "The Radio Lighthouse."

WENR
870 kc, Chicago, Ill., Great Lakes Radio Broadcasting Co., 50,000 w, C, "Voice of Service."

WEPS
1200 kc, Gloucester, Mass., Matheson Radio Co., Inc., 100 w, E.

WEVD
1300 kc, New York, N. Y., Debs Memorial Radio Fund, 500 w, E.

WEW
760 kc, St. Louis, Mo., St. Louis University, 1000 w, C.

WFAA
800 kc, Dallas, Texas News, 50,000 w, C, "Working for All Alike."

WFAN
610 kc, Philadelphia, Pa., Keystone Broadcasting Co., Inc., 500 w, E.

WFBC
1200 kc, Knoxville, Tenn., First Baptist Church, 50 w, E.

WFBG
1310 kc, Altoona, Pa., William F. Gable Co., 100 w, E, "The Original Gateway to the West and We Wish You All the Very Best."

WFBJ
1370 kc, Collegeville, Minn., St. Johns University, 100 w, C, "In the Heart of the Landscape Paradise."

WFBL
900 kc, Syracuse, N. Y., The Onondaga Co., Inc., 750 w, E, "When Feeling Blue, Listen."

WFBM
1230 kc, Indianapolis, Ind., Indianapolis Power & Light Co., 1000 w, C.

WFBR
1270 kc, Baltimore, Md., Baltimore Radio Show, Inc., 250 w, E, "Home of the Star Spangled Banner."

WFDF
1310 kc, Flint, Mich., Frank D. Fallain, 100 w, E.

WFI
560 kc, Philadelphia, Pa., Strawbridge & Clothier, 500 w, E.
"Key City of Industry."

WFIW
940 kc, Hopkinsville, Ky., The Acme Mills, Inc., 1000 w, C.

WFJC
1450 kc, Akron, Ohio, W. F. Jones Broadcasting, Inc., 500 w, E.

WFKD
1310 kc, Philadelphia, Pa., Foulkrod Radio Eng. Co., 50 w, E.

WFLA
900 kc, Clearwater, Fla., Clearwater Chamber of Commerce and St. Petersburg Chamber of Commerce, 1000 w, E, "Inviting the World to the Springtime City."

WGAL
1310 kc, Lancaster, Pa., Lancaster Elec. Sup. & Const. Co., 15 w, E, "World's Gardens at Lancaster."

WGBB
1210 kc, Freeport, N. Y., Harry H. Carman, 100 w, E, "The Voice of the Sunrise Trail."

WGBC
1430 kc, Memphis, Tenn., First Baptist Church, 500 w, C. Shared.

WGBF
630 kc, Evansville, Ind., Evansville on Air, 500 w, E, "Gateway to the South."

WGBI
880 kc, Scranton, Pa., Scranton Broadcasters, Inc., 250 w, E.

WGBS
1180 kc, New York, N. Y., General Broadcasting System, Inc., 500 w, E.

WGCM
1210 kc, Gulfport, Miss., Gulf Coast Music Co., Inc., 100 w, C.

WGCP
1250 kc, Newark, N. J., May Radio Broadcast Corp., 250 w.

WGES
1360 kc, Chicago, Ill., Oak Leaves Broadcasting Corp., 500 w, C, "World's Greatest Entertainment Service."

WGH
1310 kc, Newport News, Va., Virginia Broadcasting Co., Inc., 100 w, E.

WGHP
1240 kc, Detroit, Mich., American Broadcasting Corp., Inc., 750 w, E.

WGL
1370 kc, Ft. Wayne, Ind., Allen-Wayne Co., 100 w, C.

WGMS
See under WLB.

WGN
720 kc, Chicago, Ill., Tribune Co., 25,000 w, C.

WGR
550 kc, Buffalo, N. Y., WGR, Inc., 1000 w, E,

WGST
890 kc, Atlanta, Ga., Georgia School of Technology, 250 w, E, "The Southern School with the National Reputation."

WGY
790 kc, Schenectady, N. Y., General Electric Co., 50,000 w, E.

WHA
940 kc, Madison, Wis., University of Wisconsin, 750 w, C.

WHAD
1120 kc, Milwaukee, Wis., Marquette University 250 w, C.

WHAM
1150 kc, Rochester, N. Y., Stromberg-Carlson Tel. Mfg. Co., 5000 w, E.

WHAP
1300 kc, New York, N. Y., Defenders of Truth Society, Inc., 1000 w, E.

WHAS
820 kc, Louisville, Ky., The Courier Journal Co. & Louisville Times Co., 5000 w, C.

WHAZ
1300 kc, Troy, N. Y., Rensselaer Polytechnic Institute, 500 w, E.

WHB
950 kc, Kansas City, Mo., Sweeney Auto School, 500 w, C.

WHBC
1200 kc, Canton, Ohio, St. John's Catholic Church, 10 w, E.

WHBD
1370 kc, Bellefontaine, Ohio, F. P. Moler, 100 w, E, "Ohio's Highest Point."

WHBF
1210 kc, Rock Island, Ill., Beardsley Specialty Co., 100 w, C.

WHBL
1410 kc, Sheboygan, Wis., Press Pub. Co., 500 w, C.

WHBP
1310 kc, Johnstown, Pa., Johnstown Automobile Co., 100 w, E, "The Voice of the Friendly City."

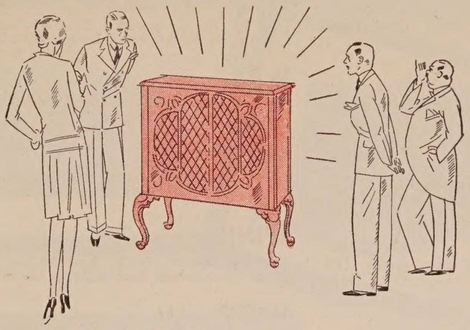
WHBQ
1370 kc, Memphis, Tenn., Broadcasting Station WHBQ, Inc., 100 w, C.

WHBU
1210 kc, Anderson, Ind., Citizens Bank, 100 w, C, "First Hoosier Bank on the Air."

WHBY
1200 kc, West De Pere, Wis., St. Norbert's College, 100 w, C.

WHDF
1370 kc, Calumet, Mich., C. C. MacLeod, 100 w, C.

WHDH
830 kc, Gloucester, Mass., Matheson Radio Co., Inc., 1000 w, E.

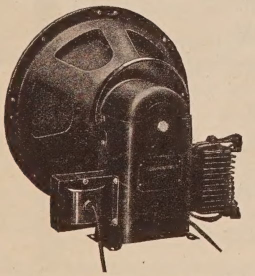


Beautiful . . . but inarticulate

Radio sets may be cleverly engineered . . . they may look like a million dollars. But, unless hooked up to the best speaker unit their performance is not in keeping. For radio sets are sold on sound.

The speaker that sells sets is free from rattle and AC hum . . . gives depth to every tone and definition to every instrument . . . and can be guaranteed for a lifetime. That speaker is the New Magnavox X-Core Dynamic.

Add to these qualities: assurance of deliveries, patent protection, elimination of most of your service troubles, and the prestige of the Magnavox name.



Models 401, 403 and 405
12¼" high, 12" wide, 8¼" deep
10½" cone

THE MAGNAVOX COMPANY
Factory and Pacific Sales: OAKLAND, CALIF.
Factory and Sales East of the Rockies: CHICAGO, ILL.

MAGNAVOX X-CORE DYNAMIC SPEAKER

WHDI
1180 kc, Minneapolis, Minn., Wm. Hood Dunwoody Ind. Inst., 500 w, C.

WHDL
1420 kc, Tupper Lake, N. Y., George Franklin Bissell, 10 w, E.

WHEC
1440 kc, Rochester, N. Y., Hickson Electric Co., Inc., 500 w, E.

WHFC
1310 kc, Cicero, Ill., Triangle Broadcasters, 100 w, C.

WHIS
1420 kc, Bluefield, W. Va., Daily Telegraph Printing Co., 100 w, E.

WHK
1390 kc, Cleveland, Ohio, Radio Air Service Corp., 1000 w, E, "Cleveland's Pioneer Station."

WHN
1010 kc, New York, N. Y., Marcus Loew Booking Review, 250 w, E, "Voice of the Great White Way."

WHO
1000 kc, Des Moines, Iowa, Bankers Life Co., 5000 w, C, "W-H-O, Who? Banker's Life, Des Moines."

WHP
1430 kc, Harrisburg, Pa., Pennsylvania Broadcasting Co., 500 w, E.

WIAS
1420 kc, Ottumwa, Iowa, Poling Electric Co., 100 w, C.

WIBA
1210 kc, Madison, Wis., Capital Times-Strand Theater Station, 100 w, C.

WIBG
930 kc, Elkins Park, Pa., St. Paul's M. E. Church, 50 w, E.

WIBM
1370 kc, Jackson, Mich., C. L. Carrell, 100 w.

WIBO
570 kc, Chicago, Ill., Nelson Bros. Bond & Mortgage Co., 1000 w, C.

WIBR
1420 kc, Steubenville, Ohio, Thurman A. Owings, 50 w, E, "Where Investments Bring Results."

WIBS
1450 kc, Elizabeth, N. J., New Jersey Broadcasting Co., 250 w, E.

WIBU
1310 kc, Poynette, Wis., W. C. Forrest, 100 w, C.

WIBW
1300 kc, Topeka, Kan., Topeka Broadcasting Assn., Inc., 1000 w, C, "Topeka—Where Investment Brings Wealth."

WIBX
1200 kc, Utica, N. Y., WIBX, Inc., 100 w, E.

WICC
1190 kc, Bridgeport, Conn., Bridgeport Broadcasting Station, Inc., 500 w, E, "The Industrial Capital of Connecticut."

WIL
1200 kc, St. Louis, Mo., Missouri Broadcasting Co., 100 w, C, "A Wave Length Ahead."

WILL
890 kc, Urbana, Ill., University of Illinois, 250 w, C.

WILM
1420 kc, Wilmington, Del., Delaware Broadcasting Co., Inc., 100 w, E.

WINR
1210 kc, Bayshore, N. Y., Radiotel Mfg. Co., 100 w, E, "The Garden Spot of Long Island."

WIOD
560 kc, Miami Beach, Fla., Isle of Dreams Broadcasting Co., 1000 w, E, "Wonderful Isle of Dreams."

WIP
610 kc, Philadelphia, Pa., Gimbel Bros., Inc., 500 w, E, "Watch Its Progress."

WISN
1120 kc, Milwaukee, Wis., Evening Wisconsin Co., 250 w, C.

WJAD
1240 kc, Waco, Texas, Frank P. Jackson, 1000 w, C, shared, "Waco, Texas, All Around It."

WJAG
1060 kc, Norfolk, Neb., Norfolk Daily News, 1000 w, C, "Home of the Printer's Devil."

WJAK
1310 kc, Marion, Ind., J. A. Kautz, 50 w.

WJAR
890 kc, Providence, R. I., The Outlet Co., 250 w, E, "The Southern Gateway of New England."

WJAS
1290 kc, Pittsburgh, Pa., Pittsburgh Radio Supply House, 1000 w, E.

WJAX
1260 kc, Jacksonville, Fla., City of Jacksonville 1000 w, E, "WJAX—W for Wonderful, JAX for Jacksonville."

WJAY
620 kc, Cleveland, Ohio, Cleveland Radio Broadcasting Corp., 500 w, E.

WJAZ
1480 kc, Chicago, Ill., Zenith Radio Corp., 5000 w, C.

WJBC
1200 kc, LaSalle, Ill., Hummer Furniture Co., 100 w, C.

WJBI
1210 kc, Red Bank, N. J., Robt. S. Johnson, 100 w, E.

WJBK
1370 kc, Ypsilanti, Mich., J. F. Hopkins, 50 w, C.

WJBL
1200 kc, Decatur, Ill., Wm. Gushard Dry Goods Co., 100 w, C.

WJBO
1370 kc, New Orleans, La., Valdemar Jensen, 100 w, C.

WJBT
See under WBBM.

WJBU
1210 kc, Lewisburg, Pa., Bucknell University, 100 w, E, "In the Heart of the Keystone State."

WJBW
1200 kc, New Orleans, La., C. Carlsen, Jr., 30 w, C, "The Serve You Broadcasting Sttaion at New Orleans.

WJBY
1210 kc, Gadsden, Ala., C. J. Black, 50 w, C.

WJDW
1370 kc, Emory, Va., Emory and Henry College, 100 w, E.

WJDX
1270 kc, Jackson, Miss., Lamar Life Ins. Co., 500 w, C.

WJDZ
1310 kc, Winston-Salem, N. C., The Journal Co., 100 w, E.

WJJD
1130 kc, Mooseheart, Ill., Loyal Order of Moose, 20,000 w, C, shared, "Every Child Is Entitled to a High School Education and a Trade."

WJKS
1360 kc, Gary, Ind., Johnson-Kennedy Radio Corp., 500 w, C.

WJR
750 kc, Detroit, Mich., WJR, Inc., 5000 w, E

WJSV
1460 kc, Mt. Vernon Hills, Va., Independent Pub. Co., 10,000 w.

WJW
1210 kc, Mansfield, Ohio, Mansfield Broadcasting Association, 100 w, E.

WJZ
760 kc, New York City, N. Y., Radio Corporation of America, 30,000 w, E.

WKAQ
890 kc, San Juan, Porto Rico, Radio Corp. of Porto Rico, 500 w, E, "Porto Rico, The Island of Enchantment in the Caribbean Sea."

WKAR
1040 kc, East Lansing, Mich., Michigan State College, 1000 w, E.

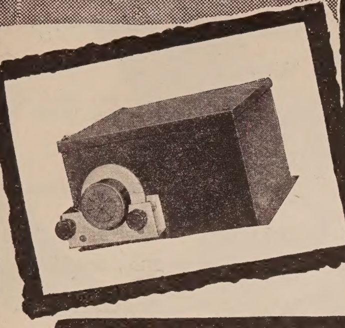
WKAV
1310 kc, Laconia, N. H., Laconia Radio Club, 100 w, E, "The Voice of the Winnepesaukee Lake Region."

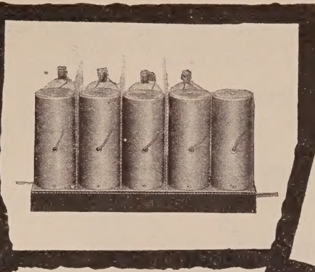
WKBB
1310 kc, Joliet, Ill., Sanders Bros., 100 k, C.

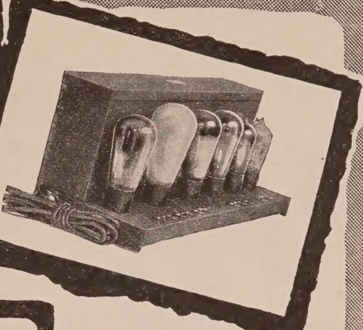
WKBC
1310 kc, Birmingham, Ala., R. B. Bryoles Furniture Co., 100 w, C.

WKBE
1200 kc, Webster, Mass., K. & B. Electric Co., 100 w, E.

WKBF
1400 kc, Indianapolis, Ind., Noble Butler Watson 500 w, C, "We Keep Building Friendships."







111

THE BIG IMPORTANT NUMBER IN 1930 RADIO

Number 111 is Remler's masterpiece, the components which combine to give you $300 worth of radio equipment for $80.

Knock-out Features . . . .

- AC Shield-Grid R. F.
- Shield-Grid Power Detector
- Band-Pass Selector
- Five-Gang Condenser
- Single-Dial Control
- Parallel First Audio Tubes
- Two "45's" in Push-Pull
- Speaker Field Supply

Check these Features . . . .

against any and all competition. What more could you ask? And every feature is employed as only Remler can employ it—to give you the finest possible radio performanee.

A NEW DEAL for the Experimenter

Here is a group of components that you can handle with real pride . . . no more apologies in competing with factory-built receivers. The Number 111 sells on its outstanding superiority. Selectivity without loss of quality such as only a band-pass selector properly used can give. Tone quality the inevitable result of the combination of "45" tubes in push-pull and Remler Audio Components.

THESE REMLER DISTRIBUTORS

will serve you promptly and courteously. They are parts specialists and carry a full line of Remler Parts as well as those of other manufacturers. You can place your entire order with any one of them with the assurance that it will be filled completely, *with the parts you specify.*

OFFENBACH ELECTRIC CO.
1452 Market St., San Francisco, Calif.
RADIO SUPPLY CO.
912 S. Broadway, Los Angeles, Calif.
NEWARK ELECTRIC CO.
226 W. Madison St., Chicago, Ill.
WESTERN RADIO MFG. CO.
128 W. Lake St., Chicago, Ill.
RADIO JOBBERS, INC.
142 Liberty St., New York City, N.Y.

GRAY & DANIELSON MANUFACTURING CO.
260 First Street, San Francisco

10 VOLUMES
of Radio Information
in 128 pages for only
50c

THE 1930
REMLER
MANUAL AND
DATA BOOK

Table of Contents

Electrical Constants in Table Form
Electrical Symbols
Ohm's Law and Impedance Calculations
Tuning Condensers
Radio and Audio Chokes
Why the By-Pass Condensers?
R F Selector Circuits
Coil Design and Tables
Tube Data
The Power Detector.
Audio Amplifiers.
Power Supply and Filter Data.
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Phonograph Pick-Ups.
Automatic Volume Controls
Receiver Kinks.
Complete Remler Catalog.

The book that every experimenter needs. Up-to-Date. Edited by Remler Engineers. Mail Your Order Direct to Us.

WKBH

1380 kc, LaCrosse, Wis., Callaway Music Co., 1000 w, C.

WKBI

1310 kc, Chicago, Ill., Fred L. Schoenwolf, 50 w, C.

WKBN

570 kc, Youngstown, Ohio, W. P. Williamson, Jr., 500 w, E.

WKBO

1450 kc, Jersey City, N. J., Camith Corp., 250 w, E.

WKBP

1420 kc, Battle Creek, Mich., Enquirer-News Co., 50 w, E.

WKBQ

1350 kc, New York, N. Y., Standard Cahill Co., Inc., 250 w, E.

WKBS

1310 kc, Galesburg, Ill., Permil N. Nelson, 100 w, C.

WKBV

1500 kc, Brookville, Ind., Knox Battery & Electric Co., 100 w, C.

WKBW

1470 kc, Buffalo, N. Y., Churchill Evan. Assn., Inc., 5000 w, E.

WKBZ

1500 kc, Ludington, Mich., K. L. Ashbacker, 50 w.

WKEN

1040 kc, Buffalo, N. Y., WKEN, Inc., 1000 w, E.

WKJC

1200 kc, Lancaster, Pa., Kirk Johnson & Co., 100 w, E.

WKRC

550 kc, Cincinnati, Ohio, Kodel Radio Corp., 500 w, E, "WKRC, K—Kodel, R—Radio, C—Corporation."

WKY

900 kc, Oklahoma City, Okla., WKY Radiophone Co., 1000 w, C.

WLAC

1490 kc, Nashville, Tenn., Life & Casualty Ins. Co., 5000 w, C, "The Thrift Station."

WLAP

1200 kc, Louisville, Ky., American Broadcasting Corp. of Kentucky, 30 w, C.

WLB

1250 kc, Minneapolis, Minn., University of Minnesota, 500 w, C.

WLBC

1310 kc, Muncie, Ind., Donald A. Burton, 50 w.

WLBF

1420 kc, Kansas City, Kan., Everett L. Dillard, 100 w, C, "Where Listeners Become Friends."

WLBG

1200 kc, Petersburg, Va., Robert Allen Gamble, 100 w, E.

WLBL

900 kc, Stevens Point, Wis., Wisconsin Department of Markets, 2000 w, daytime, C, "Wisconsin, Land of Beautiful Lakes."

WLBW

1260 kc, Oil City, Pa., Petroleum Telephone Co., 500 w, E.

WLBX

1500 kc, Long Island City, N. Y., John N. Brahy, 100 w.

WLBZ

620 kc, Bangor, Me., Maine Broadcasting Co., 250 w, E.

WLCI

1210 kc, Ithaca, N. Y., Lutheran Assn. of Ithaca, 50 w, E.

WLEX

1360 kc, Lexington, Mass., Lexington Air Station, 500 w, E.

WLEY

1420 kc, Lexington, Mass., Lexington Air Station, 100 w, E.

WLIB

See under WGN.

WLIT

560 kc, Philadelphia, Pa., Lit Brothers, 500 w, E, "The Quaker City Siren."

WLOE

1500 kc, Boston, Mass., Boston Broadcasting Co., 100 w.

WLS

870 kc, Chicago, Ill., Agricultural Broadcasting Co., 5000 w, C.

WLSI

See under WDWF.

WLTH

1400 kc, Brooklyn, N. Y., Voice of Brooklyn, Inc., 500 w, E.

WLW

700 kc, Cincinnati, Ohio, Crosley Radio Corp., 50,000 w, E.

WLWL

1100 kc, New York, N. Y., Missionary Society of St. Paul, 5000 w, 6-8 pm, E.

WMAC

570 kc, Casenovia, N. Y., Clive B. Meredith, 250 w, E, "Voice of Central New York."

WMAF

1360 kc, Dartmouth, Mass., Round Hills Radio Corp., 500 w, E.

WMAK

900 kc, Buffalo, N. Y., WMAK Broadcasting System, Inc., 750 w, E.

WMAL

630 kc, Washington, D. C., M. A. Leese Co., 250 w, E.

WMAN

1210 kc, Columbus, Ohio, W. E. Heskitt, 50 w, E.

WMAQ

670 kc, Chicago, Ill., Chicago Daily News, Inc., 5000 w, C.

WMAY

1200 kc, St. Louis, Mo., Kingshighway Presbyterian Church, 100 w, C.

WMAZ

890 kc, Macon, Ga., Macon Junior Chamber of Commerce, 250 w, E, shared, "Watch Mercer Attain Zenith."

WMBA

1500 kc, Newport, R. I., LeRoy Joseph Beebe, 100 w, E.

WMBC

1420 kc, Detroit, Mich., Michigan Broadcasting Co., Inc., 100 w, E.

WMBD

1440 kc, Peoria Heights, Ill., Peoria Heights Radio Laboratory, 500 w.

WMBG

1210 kc, Richmond, Va., Havens & Martin, Inc., 100 w, E, "The Daytime Station."

WMBH

1420 kc, Joplin, Mo., Edwin Dudley Aber, 100 w, C, "Where Memories Bring Happiness."

WMBI

1080 kc, Chicago, Ill., Moody Bible Institute Radio Station, 5000 w, C, shared, "The West Point of Christian Service."

WMBJ

1500 kc, Pittsburgh, Pa., Rev. J. W. Sproul, 100, E.

WMBL

1310 kc, Lakeland, Fla., Benford's Radio Studios, 100 w, E, "Lakeland—The City of Heart's Desire."

WMBO

1370 kc, Auburn, N. Y., Radio Service Laboratories, 100 w, E.

WMBQ

1500 kc, Brooklyn, N. Y., Paul J. Gollhofer, 100 w.

WMBR

1210 kc, Tampa, Fla., F. J. Reynolds, 100 w, E, "WMBR, Everything for Radio at Tampa, Fla."

WMC

780 kc, Memphis, Tenn., Memphis Commercial Appeal, Inc., 500 w, C, "WMC, Memphis, Down in Dixie."

WMCA

570 kc, New York, N. Y., Knickerbocker Broadcasting Co., Inc., 500 w, E, "Where the White Way Begins."

WMES

1500 kc, Boston, Mass., Massachusetts Educational Society, 50 w.

WMMN

890 kc, Fairmont, W. Va., Holt Rome Novelty Co., 250 w, E.

WMPC

1500 kc, Lapeer, Mich., First Methodist Protestant Church, 100 w, E, "Where Many Preach Christ."

WMRJ

1420 kc, Jamaica, N. Y., Peter J. Prinz, 10 w, E, "The Gateway of the Sunrise Trail."

WMSG

1350 kc, New York, N. Y., Madison Square Garden Broadcast Co., 250 w, E.

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WMT

1200 kc, Waterloo, Iowa, Waterloo Broadcasting Co., 100 w, C.

WNAC

1230 kc, Boston, Mass., The Shepard Norwell Co., 1000 w, E.

WNAD

1010 kc, Norman, Okla., University of Oklahoma 500 w, C, "The Voice of Soonerland."

WNAT

1310 kc, Philadelphia, Pa., Lenning Brothers Co., 100 w, E.

WNAX

570 kc, Yankton, S. Dak., Gurney Seed & Nursery Co., Dakota Radio Apparatus Co., 1000 w, C.

WNBF

1500 kc, Binghamton, N. Y., Howitt-Wood Radio Co., 50 w, E, "The Voice of the Triple Cities."

WNBH

1310 kc, New Bedford, Mass., New Bedford Broadcasting Co., 100 w, E. shared, "The Gateway to Cape Cod."

WNBJ

1310 kc, Knoxville, Tenn., Lonsdale Baptist Church, 50 w, C.

WNBO

1200 kc, Washington, Pa., J. B. Spriggs, 100 w, E.

WNBR

1430 kc, Memphis, Tenn., John Ulrich, 500 w, C.

WNBW

1200 kc, Carbondale, Pa., Home Cut Glass & China Co., 5 w, E.

WNBX

1200 kc, Springfield, Vt., First Congregational Church, Inc., 10 w, E.

WNBZ

1290 kc, Saranac Lake, N. Y., Smith & Mace, 50 w, E.

WNJ

1450 kc, Newark, N. J., Radio Investment Co., 250 w, E, "The Voice of Newark."

WNOX

560 kc, Knoxville, Tenn., Stercki Bros., 1000 w, C, "Smoky Mountain Station."

WNRC

1440 kc, Greensboro, N. C., Wayne M. Nelson, 250 w, E.

WNYC

570 kc, New York, N. Y., Department of Plant & Structures, 500 w, E, "Municipal Broadcasting Station of the City of New York."

WOAI

1190 kc, San Antonio, Texas, Southern Equipment Co., 5000 w, C, "The Winter Playground of America."

WOAN

600 kc, Lawrenceburg, Tenn., J. D. Vaughan, 500 w, C, "Watch Our Annual Normal."

WOAX

1280 kc, Trenton, N. J., Franklyn J. Wolff, 500 w, E, "Trenton Makes, the World Takes."

WOBT

1310 kc, Union City, Tenn., Titsworth's Radio & Music Shop, 15 w, C.

WOBU

580 kc, Charleston, W. Va., Charleston Radio Broadcasting Co., 250 w, E.

WOC

1000 kc, Davenport, Iowa, Palmer School of Chiropractic, 5000 w, C.

WOCL

1210 kc, Jamestown, N.Y., A. E. Newton, 25 w, E.

WODA

1250 kc, Paterson, N. J., Richard E. O'Dea, 1000 w, E, "The Voice of the Silk City."

WOI

560 kc, Ames, Iowa, Iowa State College, 3500 w, C.

WOKO

1440 kc, Poughkeepsie, N. Y., Harold E. Smith, 500 w, E.

WOL

1310 kc, Washington, D. C., American Broadcasting Co., 100 w, E.

WOMT

1210 kc, Manitowoc, Wis., Francis M. Kadow, 100 w.

WOPI

1500 kc, Bristol, Tenn., Radiophone Service Co., 100 w, E.

WOOD

1270 kc, Grand Rapids, Mich., Walter B. Stiles, Inc., 500 w, C, "The Voice of the Whispering Pines."

WOQ

610 kc, Kansas City, Mo., Unity School of Christianity, 1000 w, C.

WOR

710 kc, Newark, N. J., L. Bamberger & Co., 5000 w, E.

WORD

1480 kc, Chicago, Ill., People's Pulpit Association, 5000 w, C, "The Watch Tower—Radio WORD."

WOS

630 kc, Jefferson City, Mo., State Marketing Bureau, 500 w, C, "Watch Our State."

WOV

1130 kc, New York, N. Y., International Broadcasting Corp., 1000 w, E.

[illegible]

WMAL

630 kc, Washington, D. C., M. A. Leese Co., 250 w, E.

WMAN

1210 kc, Columbus, Ohio, W. E. Heskitt, 50 w, E.

WMAQ

670 kc, Chicago, Ill., Chicago Daily News, Inc., 5000 w, C.

WPAW

1210 kc, Pawtucket, R. I., Shartenberg & Robinson, 100 w, E, "The City of Diversified Industries."

WPCC

570 kc, Chicago, Ill., North Shore Congregational Church, 500 w, C.

WPCH

810 kc, New York, N. Y., Eastern Broadcasters, Inc., 500 w, E.

WPG

1100 kc, Atlantic City, N. J., Municipality of Atlantic City, 5000 w, E.

WPOE

1420 kc, Patchogue, N. Y., Nassau Broadcasting Corp., 30 w, E.

WPOR

See under WTAR.

WPRC

1200 kc, Harrisburg, Pa., Wilson Printing & Radio Co., 100 w, E.

WPSC

1230 kc, State College, Pa., Pennsylvania State College, 500 w, day, E, "The Voice of the Nittany Lion."

WPSW

1500 kc, Philadelphia, Pa., Wm. Penn Broadcasting Co., 50 w, E, "First Wireless School in America."

WPTF

680 kc, Raleigh, N. C., Durham Life Insurance Co., 1,000 w, E.

WQAM

1240 kc, Miami, Fla., Miami Broadcasting Co., 100 w, E.

WQAN

880 kc, Scranton, Pa., Scranton Times, 250 w, E.

WQAO

1010 kc, New York, N. Y., Calvary Baptist Church, 250 w, E.

WQBC

1360 kc, Utica, Miss., Utica Chamber of Commerce, 300 w, C.

WQBZ

1420 kc, Weirton, W. Va., J. H. Thompson, 60 k, E.

WRAF

1200 kc, La Porte, Ind., The Radio Club, Inc., 100 w.

WMPC

C. R. Cummins, 50 w, E.

1500 kc, Lapeer, .
Church, 100 w, E

WMRJ

'a., Avenue Radio & Electric

1420 kc, Jamaica, N
"The Gateway of th

Schuylkill Valley Echo."

WMSG

Pa., Berachah Church, Inc.,

1350 kc, New York,
den Broadcast Co., 2.

"Isn't it about time, Dad, you eliminated the 'adenoids'?"

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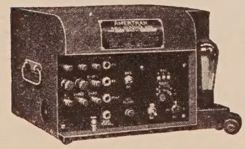
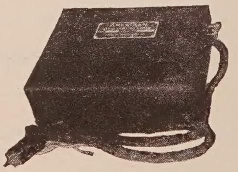


AmerTran ABC Hi-Power Box—500 volts DC plate voltage, current up to 110 ma; AC filament current for all tubes for any set. Adjustable bias voltages for all tubes. Price, east of Rockies—less tubes—$95.00.



Complete 2 stage audio amplifier. First stage AmerTran DeLuxe for UX 227 AC and second stage AmerTran Push-Pull for two 171 or two 210 Power Tubes. Price, east of Rockies—less tubes—$60.00.

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WRBC

1240 kc, Valparaiso, Ind., Immanuel Lutheran Church, 500 w, C, "World Redeemed by Christ."

WRBI

1310 kc, Tifton, Ga., Kent's Furniture & Music Store, 20 w, E.

WRBJ

1500 kc, Hattiesburg, Miss., Woodruff Furniture Co., 10 w, C.

WRBL

1200 kc, Columbus, Ga., Roy E. Martin, 50 w, E.

WRBQ

1210 kc, Greenville, Miss., J. Pat Scully, 100 w, C.

WRBT

1370 kc, Wilmington, N. C., Wilmington Radio Association, 100 w, E.

WRBU

1210 kc, Gastonia, N. C., A. J. Kirby Music Co., 100 w, E.

WRC

950 kc, Washington, D. C., Radio Corporation of America, 500 w, E, "The Voice of the Capital."

WREC

600 kc, Whitehaven, Tenn., WREC, Inc., 500 w.

WREN

1220 kc, Lawrence, Kan., Jenny Wren Co., 1000 w, C.

WRHM

1250 kc, Minneapolis, Minn., Rosedale Hospital Co., Inc., 1000 w, C, "Welcome Rosedale Hospital, Minneapolis."

WRJN

1370 kc, Racine, Wis., Racine Broadcasting Corp., 100 w, C.

WRK

1310 kc, Hamilton, Ohio, S. W. Doron & John C. Slade, 100 w, E, "The Voice of Hamilton."

WRNY

1010 kc, New York, N. Y., Aviation Radio Station, 250 w, E.

WRR

1280 kc, Dallas, Texas, City of Dallas, 500 w, C.

WRUF

1470 kc, Gainesville, Fla., University of Florida, 5000 w, E.

WRVA

1110 kc, Richmond, Va., Larus Bros. & Co., Inc., 5000 w, E, "Carry Me Back to Old Virginny."

WSAI

1330 kc, Cincinnati, Ohio, Crosley Radio Corp., 500 w, E, "The Gateway to Dixie."

WSAJ

1310 kc, Grove City, Pa., Grove City College, 100 w, E.

WSAN

1440 kc, Allentown, Pa., Allentown Call Pub. Co., 250 w, E, "We Serve Allentown Nationality." ity."

WSAR

1450 kc, Fall River, Mass., Doughty & Welch Electrical Co., Inc., 250 w, E.

WSAZ

580 kc, Huntington, W. Va., McKellar Electric Co., 250 w, E.

WSB

740 kc, Atlanta, Ga., Atlanta Journal Co., 1000 w, E, "The Voice of the South."

WSBC

1210 kc, Chicago, Ill., World Battery Co., 100 w, C.

WSBT

1230 kc, South Bend, Ind., South Bend Tribune, 500 w. C.

WSDA

See under WSGH.

WSGH

1400 kc, Brooklyn, N. Y., Amateur Radio Specialty Co., 500 w.

WSGP

1410 kc, Savannah, Ga., Chamber of Commerce, 500 w, E.

WSIX

1210 kc, Springfield, Tenn., 638 Tire & Vulcanizing Co., 100 w, C.

WSM

650 kc, Nashville, Tenn., National Life & Accident Ins. Co., 5000 w, C, "We Shield Millions."

WSMB

1320 kc, New Orleans, La., Saenger Theaters, Inc., & Maison Blanche Co., 500 w, C, "America's Most Interesting City."

WSMK

570 kc, Dayton, Ohio, Stanley M. Krohn, Jr., 200 w, C, "The Home of Aviation."

WSOA

1480 kc, Forest Park, Ill., Radiophone Broadcasting Corp., 5000 w, C.

WSPD

1340 kc, Toledo, Ohio, Toledo Broadcasting Co., 500 w, E.

WSSH

1420 kc, Boston, Mass., Tremont Temple Baptist Church, 100 w, E, "Stranger's Sunday Home."

WSUI

580 kc, Iowa City, Iowa, State Univ. of Iowa, 500 w, C, "The Old Gold Studio."

WSUN

See under WFLA.

WSVS

1370 kc, Buffalo, N. Y., Seneca Vocational School, 50 w, E, "Watch Seneca Vocational School."

WSYR

570 kc, Syracuse, N. Y., Clive B. Merewith, 250 w, E.

WTAD

1440 kc, Quincy, Ill., Illinois Stock Medicine Broadcasting Corp., 500 w.

WTAG

580 kc, Worcester, Mass., Worcester Telegram Pub. Co., Inc., 250 w, E, "The Voice From the Heart of the Commonwealth."

WTAM

1070 kc, Cleveland, Ohio, WTAM & WEAR, Inc., 3500 w, E, "The Voice From the Storage Battery."

WTAQ

1330 kc, Eau Claire, Wis., Gillette Rubber Co., 1000 w, C.

WTAR

780 kc, Norfolk, Va., WTAR Radio Corp., 500 w. E.

WTAW

1120 kc, College Station, Texas, Agri. & Mech. College of Texas, 500 w, C.

WTAX

1210 kc, Streator, Ill., Williams Hardware Co., 50 w.

WTBO

1420 kc, Cumberland, Md., Cumberland Electric Co., 50 w, E.

WTFI

1450 kc, Toccoa, Ga., Toccoa Falls Institute, 250 w, E.

WTIC

600 kc, Hartford, Conn., Travels Broadcasting Service Corp., 250 w, E, "The Insurance City."

WTMJ

620 kc, Milwaukee, Wis., Milwaukee Journal, 1000 w, C.

WWAE

1200 kc, Hammond, Ind., Hammond-Calumet Broadcasting Corp., 100 w.

WWJ

920 kc, Detroit, Mich., The Detroit News, 1000 w, E.

WWL

850 kc, New Orleans, La., Loyola University, 5000 w, C.

WWNC

570 kc, Asheville, N. C., Citizens Broadcasting Co., 1000 w, E.

WWRL

1500 kc, Woodside, N. Y., Long Island Broadcasting Corp., 100 W.

WWVA

1160 kc, Wheeling, W. Va., West Virginia Broadcasting Corp., 250 w, E.

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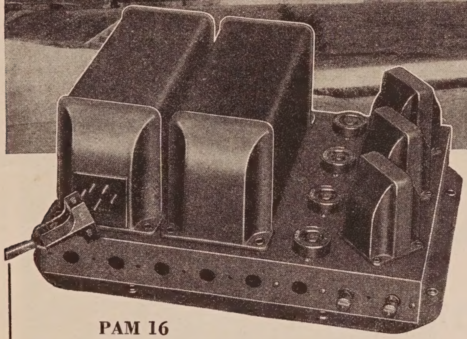
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KDB—Santa Barbara, Calif.
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KDLR—Devils Lake, N. D.
KDYL—Salt Lake City, Utah
KEJK—Beverly Hills, Calif.
KELW—Burbank, Calif.
KEX—Portland, Ore.
KFAB—Lincoln, Neb.
KFAD—Phoenix, Ariz.
KFBB—Havre, Mont.
KFBK—Sacramento, Calif.
KFBL—Everett, Wash.
KFDM—Beaumont, Tex.
KFDY—Brookings, S. D.
KFEL—Denver, Colo.
KFEQ—St. Joseph, Mo.
KFGQ—Boone, Iowa
KFH—Wichita, Kans.
KFHA—Gunnison, Colo.
KFI—Los Angeles, Calif.
KFIF—Portland, Ore.
KFIO—Spokane, Wash.
KFIZ—Fond du Lac, Wis.
KFJB—Marshalltown, Iowa.
KFJF—Oklahoma City, Okla.
KFJI—Astoria, Ore.
KFJM—Grand Forks, N. D.
KFJR—Portland, Ore.
KFJY—Fort Dodge, Ia.
KFJZ—Fort Worth, Tex.
KFKA—Greeley, Colo.
KFKB—Milford, Kans.
KFKU—Lawrence, Kans.
KFKX—Chicago, Ill.
KFKZ—Kirksville, Mo.
KFLV—Rockford, Ill.
KFLX—Galveston, Tex.
KFMX—Northfield, Minn.
KFNF—Shenandoah, Ia.
KFOR—Lincoln, Neb.
KFOX—Long Beach, Calif.
KFPL—Dublin, Tex.
KFPM—Greenville, Tex.
KFPW—Siloam Springs, Ark.
KFPY—Spokane, Wash.
KFQA—St. Louis, Mo.
KFQD—Anchorage, Alaska
KFQU—Holy City, Calif.
KFQW—Seattle, Wash.
KFQZ—Hollywood, Calif.
KFRC—San Francisco, Calif.
KFRU—Columbia, Mo.
KFSD—San Diego, Calif.
KFSG—Los Angeles, Calif.
KFUL—Galveston, Tex.
KFUM—Colorado Spgs., Colo.
KFUO—St. Louis, Mo.
KFUP—Denver, Colo.
KFVD—Culver City, Calif.
KFVS—Cape Girardeau, Mo.
KFWB—Hollywood, Calif.
KFWC—Ontario, Calif.
KFWF—St. Louis, Mo.
KFWI—San Francisco, Calif.
KFWM—Oakland, Calif.
KFXD—Jerome, Idaho
KFXF—Denver, Colo.
KFXJ—Edgewater, Colo.
KFXR—Oklahoma City, Okla.
KFXY—Flagstaff, Ariz.
KFYO—Abilene, Tex.
KFYR—Bismarck, N. D.
KGA—Spokane, Wash.
KGAR—Tucson, Ariz.
KGB—San Diego, Calif.
KGBU—Ketchikan, Alaska.
KGBX—St. Joseph, Mo.
KGBZ—York, Neb.
KGCA—Decorah, Ia.
KGCI—San Antonio, Tex.
KGCR—Watertown, S. D.
KGCU—Mandan, N. D.
KGCX—Vida, Mont.
KGDA—Dell Rapids, S. D.
KGDE—Fergus Falls, Minn.
KGDM—Stockton, Calif.
KGDR—San Antonio, Tex.
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KGEK—Yuma, Colo.
KGER—Long Beach, Calif.
KGEW—Fort Morgan, Colo.
KGEZ—Kalispell, Mont.
KGFF—Alva, Okla.
KGFG—Oklahoma City, Okla.
KGFI—Corpus Christi, Tex.
KGFJ—Los Angeles, Calif.
KGFK—Hallock, Minn.
KGFL—Raton, N. M.
KGFW—Ravenna, Neb.
KGFX—Pierre, S. D.
KGGC—San Francisco, Cal.
KGGF—Picher, Okla.
KGGM—Albuquerque, N. M.
KGHF—Pueblo, Colo.
KGHG—McGehee, Ark.
KGHI—Little Rock, Ark.
KGHL—Billings, Mont.
KGHX—Richmond, Tex.
KGIQ—Twin Falls, Idaho
KGIR—Butte, Mont.
KGIW—Trinidad, Colo.
KGIX—Las Vegas, N. M.
KGJF—Little Rock, Ark.
KGKB—Brownwood, Tex.
KGKL—San Angelo, Tex.
KGKO—Wichita Falls, Tex.
KGKX—Sandpoint, Idaho
KGO—Oakland, Calif.
KGRC—San Antonio, Tex.
KGRS—Amarillo, Tex.
KGU—Honolulu, T. H.
KGW—Portland, Ore.

Call Town

KGY—Lacey, Wash.
KHJ—Los Angeles, Calif.
KHQ—Spokane, Wash.
KICK—Red Oak, Ia.
KID—Idaho Falls, Idaho
KIDO—Boise, Idaho
KIT—Yakima, Wash.
KJBS—San Francisco, Calif.
KJR—Seattle, Wash.
KLCN—Blytheville, Ark.
KLO—Ogden, Utah
KLRA—Little Rock, Ark.
KLS—Oakland, Calif.
KLX—Oakland, Calif.
KLZ—Dupont, Colo.
KMA—Shenandoah, Ia.
KMBC—Independence, Mo.
KMED—Medford, Ore.
KMIC—Inglewood, Calif.
KMJ—Fresno, Calif.
KMMJ—Clay Center, Neb.
KMO—Tacoma, Wash.
KMOX—St. Louis, Mo.
KMTR—Hollywood, Calif.
KNX—Hollywood, Calif.
KOA—Denver, Colo.
KOAC—Corvallis, Ore.
KOB—State College, N. M.
KOCW—Chickasha, Okla.
KOH—Reno, Nev.
KOIL—Council Bluffs, Ia.
KOIN—Portland, Ore.
KOL—Seattle, Wash.
KOMO—Seattle, Wash.
KOOS—Marshfield, Ore.
KORE—Eugene, Ore.
KOY—Phoenix, Ariz.
KPCB—Seattle, Wash.
KPJM—Prescott, Ariz.
KPLA—Los Angeles, Calif.
KPO—San Francisco, Calif.
KPOF—Denver, Colo.
KPPC—Pasadena, Calif.
KPQ—Seattle, Wash.
KPRC—Houston, Tex.
KPSN—Pasadena, Calif.
KPWF—Westminster, Calif.
KQV—Pittsburgh, Pa.
KQW—San Jose, Calif.
KRE—Berkeley, Calif.
KRGV—Harlingen, Tex.
KRLD—Dallas, Tex.
KRMD—Shreveport, La.
KRSC—Seattle, Wash.
KSAC—Manhattan, Kans.
KSCJ—Sioux City, Ia.
KSD—St. Louis, Mo.
KSEI—Pocatello, Idaho
KSL—Salt Lake City, Utah
KSMR—Santa Maria, Calif.
KSO—Clarinda, Ia.
KSOO—Sioux Falls, S. D.
KSTP—St. Paul, Minn.
KTAB—Oakland, Calif.
KTAP—San Antonio, Tex.
KTAT—Ft. Worth, Tex.
KTBI—Los Angeles, Calif.
KTBR—Portland, Ore.
KTBS—Shreveport, La.
KTHS—Hot Springs, Ark.
KTM—Santa Monica, Calif.
KTNT—Muscatine, Ia.
KTSA—San Antonio, Tex.
KTSL—Shreveport, La.
KTUE—Houston, Tex.
KTW—Seattle, Wash.
KUJ—Longview, Wash.
KUOA—Fayetteville, Ark.
KUOM—Missoula, Mont.
KUSD—Vermillion, S. D.
KUT—Austin, Tex.
KVI—Tacoma, Wash.
KVL—Seattle, Wash.
KVOA—Tucson, Ariz.
KVOO—Tulsa, Okla.
KVOS—Bellingham, Wash.
KWBS—Portland, Ore.
KWCR—Cedar Rapids, Ia.
KWEA—Shreveport, La.
KWG—Stockton, Cal.
KWJJ—Portland, Ore.
KWK—St. Louis, Mo.
KWKC—Kansas City, Mo.
KWKH—Kennonwood, La.
KWLC—Decorah, Ia.
KWSC—Pullman, Wash.
KWTC—Santa Ana, Calif.
KWWG—Brownsville, Tex.
KWYO—Laramie, Wyo.
KXA—Seattle, Wash.
KXL—Portland, Ore.
KXO—El Centro, Calif.
KXRO—Aberdeen, Wash.
KYA—San Francisco, Calif.
KYW—Chicago, Ill.
KYWA—Chicago, Ill.
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WABO—Rochester, N. Y.
WABZ—New Orleans, La.
WADC—Akron, Ohio
WAFD—Detroit, Mich.
WAGM—Royal Oak, Mich.
WAIU—Columbus, Ohio
WAPI—Birmingham, Ala.
WASH—Grand Rapids, Mich.
WBAK—Harrisburg, Pa.
WBAL—Baltimore, Md.
WBAP—Fort Worth, Tex.

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WBAW—Nashville, Tenn.
WBAX—Wilkes-Barre, Pa.
WBBC—Brooklyn, N. Y.
WBBL—Richmond, Va.
WBBM—Chicago, Ill.
WBBR—Rossville, N. Y.
WBBY—Charleston, S. C.
WBBZ—Ponca City, Okla.
WBCM—Bay City, Mich.
WBCN—Chicago, Ill.
WBIS—Boston, Mass.
WBMS—Fort Lee, N. J.
WBNY—New York, N. Y.
WBOQ—New York, N. Y.
WBOW—Terre Haute, Ind.
WBRC—Birmingham, Ala.
WBRE—Wilkes-Barre, Pa.
WBRL—Tilton, N. H.
WBSO—Wellesley Hills, Mass.
WBT—Charlotte, N. C.
WBZ—Springfield, Mass.
WBZA—Boston, Mass.

WCAC—Storrs, Conn.
WCAD—Canton, N. Y.
WCAE—Pittsburgh, Pa.
WCAH—Columbus, Ohio
WCAJ—Lincoln, Neb.
WCAL—Northfield, Minn.
WCAM—Camden, N. J.
WCAO—Baltimore, Md.
WCAP—Asbury Park, N. J.
WCAT—Rapid City, S. D.
WCAU—Philadelphia, Pa.
WCAZ—Carthage, Ill.
WCBA—Allentown, Pa.
WCBD—Zion, Ill.
WCBM—Baltimore, Md.
WCBS—Springfield, Ill.
WCCO—Minneapolis, Minn.
WCDA—New York, N. Y.
WCFL—Chicago, Ill.
WCGU—Coney Island, N. Y.
WCKY—Covington, Ky.
WCLB—Long Beach, N. Y.
WCLO—Kenosha, Wis.
WCLS—Joliet, Ill.
WCMA—Culver, Ind.
WCOA—Pensacola, Fla.
WCOC—Columbus, Miss.
WCOH—Yonkers, N. Y.
WCRW—Chicago, Ill.
WCSH—Portland, Me.
WCSO—Springfield, Ohio

WDAE—Tampa, Fla.
WDAF—Kansas City, Mo.
WDAG—Amarillo, Tex.
WDAH—El Paso, Tex.
WDAY—Fargo, N. D.
WDBJ—Roanoke, Va.
WDBO—Orlando, Fla.
WDEL—Wilmington, Del.
WDGY—Minneapolis, Minn.
WDOD—Chattanooga, Tenn.
WDRC—New Haven, Conn.
WDSU—New Orleans, La.
WDWF—Providence, R. I.
WDZ—Tuscola, Ill.

WEAF—New York, N. Y.
WEAI—Ithaca, N. Y.
WEAN—Providence, R. I.
WEAO—Columbus, Ohio
WEAR—Cleveland, Ohio
WEBC—Duluth, Minn.
WEBE—Cambridge, Ohio
WEBQ—Harrisburg, Ill.
WEBR—Buffalo, N. Y.
WEBW—Beloit, Wis.
WEDC—Chicago, Ill.
WEDH—Erie, Pa.
WEEI—Boston, Mass.
WEHS—Evanston, Ill.
WELK—Philadelphia, Pa.
WEMC—Berrien Springs, Mich.
WENR—Chicago, Ill.
WEPS—Gloucester, Mass.
WEVD—New York, N. Y.
WEW—St. Louis, Mo.
WFAA—Dallas, Tex.
WFAN—Philadelphia, Pa.
WFBC—Knoxville, Tenn.
WFBG—Altoona, Pa.
WFBJ—Collegeville, Minn.
WFBL—Syracuse, N. Y.
WFBM—Indianapolis, Ind.
WFBR—Baltimore, Md.
WFDF—Flint, Mich.
WFI—Philadelphia, Pa.
WFIW—Hopkinsville, Ky.
WFJC—Akron, Ohio
WFKD—Philadelphia, Pa.
WFLA—Clearwater, Fla.
WGAL—Lancaster, Pa.
WGBB—Freeport, N. Y.
WGBC—Memphis, Tenn.
WGBF—Evansville, Ind.
WGBI—Scranton, Pa.
WGBS—New York, N. Y.
WGCM—Gulfport, Miss.
WGCP—Newark, N. J.
WGES—Chicago, Ill.
WGH—Newport News, Va.
WGHP—Detroit, Mich.
WGL—Fort Wayne, Ind.
WGMS—Minneapolis, Minn.
WGN—Chicago, Ill.
WGR—Buffalo, N. Y.
WGST—Atlanta, Ga.
WGY—Schenectady, N. Y.
WHA—Madison, Wis.
WHAD—Milwaukee, Wis.
WHAM—Rochester, N. Y.
WHAP—New York, N. Y.
WHAS—Louisville, Ky.

Call Town

WHAZ—Troy, N. Y.
WHB—Kansas City, Mo.
WHBC—Canton, Ohio
WHBD—Bellefontaine, Ohio
WHBF—Rock Island, Ill.
WHBL—Sheboygan, Wis.
WHBP—Johnstown, Pa.
WHBQ—Memphis, Tenn.
WHBU—Anderson, Ind.
WHBY—West De Pere, Wis.
WHDF—Calumet, Mich.
WHDH—Gloucester, Mass.
WHDI—Minneapolis, Minn.
WHDL—Tupper Lake, N. Y.
WHEC—Rochester, N. Y.
WHFC—Cicero, Ill.
WHIS—Bluefield, W. Va.
WHK—Cleveland, Ohio
WHN—New York, N. Y.
WHO—Des Moines, Iowa
WHP—Harrisburg, Pa.
WIAS—Ottumwa, Ia.
WIBA—Madison, Wis.
WIBG—Elkins Park, Pa.
WIBM—Jackson, Mich.
WIBO—Chicago, Ill.
WIBR—Steubenville, Ohio
WIBS—Elizabeth, N. J.
WIBU—Poynette, Wis.
WIBW—Topeka, Kans.
WIBX—Utica, N. Y.
WICC—Bridgeport, Conn.
WIL—St. Louis, Mo.
WILL—Urbana, Ill.
WILM—Wilmington, Del.
WINR—Bay Shore, N. Y.
WIOD—Miami Beach, Fla.
WIP—Philadelphia, Pa.
WISN—Milwaukee, Wis.
WJAD—Waco, Tex.
WJAG—Norfolk, Neb.
WJAK—Marion, Ind.
WJAR—Providence, R. I.
WJAS—Pittsburgh, Pa.
WJAX—Jacksonville, Fla.
WJAY—Cleveland, Ohio
WJAZ—Chicago, Ill.
WJBC—LaSalle, Ill.
WJBI—Red Bank, N. J.
WJBK—Ypsilanti, Mich.
WJBL—Decatur, Ill.
WJBO—New Orleans, La.
WJBT—Chicago, Ill.
WJBU—Lewisburg, Pa.
WJBW—New Orleans, La.
WJBY—Gadsden, Ala.
WJDW—Emory, Va.
WJDX—Jackson, Miss.
WJDZ—Winston-Salem, N. C.
WJJD—Mooseheart, Ill.
WJKS—Gary, Ind.
WJR—Detroit, Mich.
WJSV—Mt. Vernon Hills, Va.
WJW—Mansfield, Ohio
WJZ—New York, N. Y.
WKAQ—San Juan, P. R.
WKAR—E. Lansing, Mich.
WKAV—Laconia, N. H.
WKBB—Joliet, Ill.
WKBC—Birmingham, Ala.
WKBE—Webster, Mass.
WKBF—Indianapolis, Ind.
WKBH—La Crosse, Wis.
WKBI—Chicago, Ill.
WKBN—Youngstown, Ohio
WKBO—Jersey City, N. J.
WKBP—Battle Creek, Mich.
WKBQ—New York, N. Y.
WKBS—Galesburg, Ill.
WKBV—Brookville, Ind.
WKBW—Buffalo, N. Y.
WKBZ—Ludington, Mich.
WKEN—Buffalo, N. Y.
WKJC—Lancaster, Pa.
WKRC—Cincinnati, Ohio
WKY—Oklahoma City, Okla.
WLAC—Nashville, Tenn.
WLAP—Louisville, Ky.
WLB—Minneapolis, Minn.
WLBC—Muncie, Ind.
WLBF—Kansas City, Kans.
WLBG—Petersburg, Va.
WLBL—Stevens Point, Wis.
WLBW—Oil City, Pa.
WLBX—Long Island City, N. Y.
WLBZ—Bangor, Me.
WLCI—Ithaca, N. Y.
WLEX—Lexington, Mass.
WLEY—Lexington, Mass.
WLIB—Chicago, Ill.
WLIT—Philadelphia, Pa.
WLOE—Boston, Mass.
WLS—Chicago, Ill.
WLSI—Providence, R. I.
WLTH—Brooklyn, N. Y.
WLW—Cincinnati, Ohio
WLWL—New York, N. Y.
WMAC—Cazenovia, N. Y.
WMAF—Dartmouth, Mass.
WMAK—Buffalo, N. Y.
WMAL—Washington, D. C.
WMAN—Columbus, Ohio
WMAQ—Chicago, Ill.
WMAY—St. Louis, Mo.
WMAZ—Macon, Ga.
WMBA—Newport, R. I.
WMBC—Detroit, Mich.
WMBD—Peoria Heights, Ill.
WMBG—Richmond, Va.
WMBH—Joplin, Mo.
WMBI—Chicago, Ill.
WMBJ—Pittsburgh, Pa.
WMBL—Lakeland, Fla.
WMBO—Auburn, N. Y.

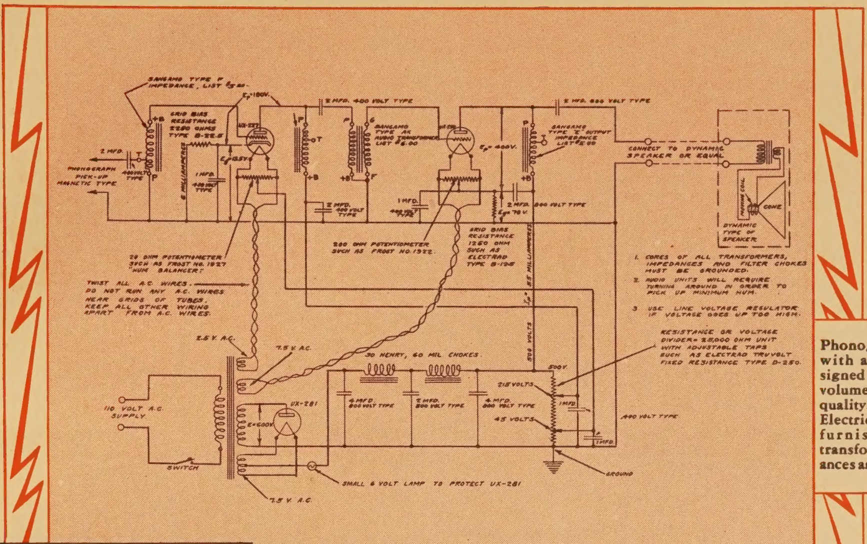
Call Town

WMBQ—Brooklyn, N. Y.
WMBR—Tampa, Fla.
WMC—Memphis, Tenn.
WMCA—New York, N. Y.
WMES—Boston, Mass.
WMMN—Fairmont, W. Va.
WMPC—Lapeer, Mich.
WMRJ—Jamaica, N. Y.
WMSG—New York, N. Y.
WMT—Waterloo, Ia.

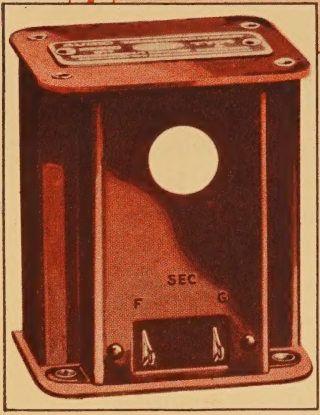
WNAC—Boston, Mass.
WNAD—Norman, Okla.
WNAT—Philadelphia, Pa.
WNAX—Yankton, S. D.
WNBF—Binghamton, N. Y.
WNBH—New Bedford, Mass.
WNBJ—Knoxville, Tenn.
WNBO—Washington, Pa.
WNBR—Memphis, Tenn.
WNBW—Carbondale, Pa.
WNBX—Springfield, Vt.
WNBZ—Saranac Lake, N. Y.
WNJ—Newark, N. J.
WNOX—Knoxville, Tenn.
WNRC—Greensboro, N. C.
WNYC—New York, N. Y.

WOAI—San Antonio, Tex.
WOAN—Lawrenceburg, Tenn.
WOAX—Trenton, N. J.
WOBT—Union City, Tenn.
WOBU—Charleston, W. Va.
WOC—Davenport, Ia.
WOCL—Jamestown, N. Y.
WODA—Paterson, N. J.
WOI—Ames, Ia.
WOKO—Poughkeepsie, N. Y.
WOL—Washington, D. C.
WOMT—Manitowoc, Wis.
WOPI—Bristol, Tenn.
WOOD—Grand Rapids, Mich.
WOQ—Kansas City, Mo.
WOR—Newark, N. J.
WORD—Chicago, Ill.
WOS—Jefferson City, Mo.
WOV—New York, N. Y.
WOW—Omaha, Neb.
WOWO—Ft. Wayne, Ind.

WPAP—New York, N. Y.
WPAW—Pawtucket, R. I.
WPCC—Chicago, Ill.
WPCH—New York, N. Y.
WPG—Atlantic City, N. J.
WPOE—Patchogue, N. Y.
WPOR—Norfolk, Va.
WPRC—Harrisburg, Pa.
WPSC—State College, Pa.
WPSW—Philadelphia, Pa.
WPTF—Raleigh, N. C.
WQAM—Miami, Fla.
WQAN—Scranton, Pa.
WQAO—New York, N. Y.
WQBC—Utica, Miss.
WQBZ—Weirton, W. Va.
WRAF—La Porte, Ind.
WRAK—Erie, Pa.
WRAW—Reading, Pa.
WRAX—Philadelphia, Pa.
WRBC—Valparaiso, Ind.
WRBI—Tifton, Ga.
WRBJ—Hattiesburg, Miss.
WRBL—Columbus, Ga.
WRBQ—Greenville, Miss.
WRBT—Wilmington, N. C.
WRBU—Gastonia, N. C.
WRC—Washington, D. C.
WREC—Whitehaven, Tenn.
WREN—Lawrence, Kans.
WRHM—Minneapolis, Minn.
WRJN—Racine, Wis.
WRK—Hamilton, Ohio
WRNY—New York, N. Y.
WRR—Dallas, Tex.
WRUF—Gainesville, Fla.
WRVA—Richmond, Va.
WSAI—Cincinnati, Ohio
WSAJ—Grove City, Pa.
WSAN—Allentown, Pa.
WSAR—Fall River, Mass.
WSAZ—Huntington, W. Va.
WSB—Atlanta, Ga.
WSBC—Chicago, Ill.
WSBT—South Bend, Ind.
WSDA—Brooklyn, N. Y.
WSGH—Brooklyn, N. Y.
WSGP—Savannah, Ga.
WSIX—Springfield, Tenn.
WSM—Nashville, Tenn.
WSMB—New Orleans, La.
WSMK—Dayton, Ohio
WSOA—Forest Park, Ill.
WSPD—Toledo, Ohio
WSSH—Boston, Mass.
WSUI—Iowa City, Ia.
WSUN—Clearwater, Fla.
WSVS—Buffalo, N. Y.
WSYR—Syracuse, N. Y.
WTAD—Quincy, Ill.
WTAG—Worcester, Mass.
WTAM—Cleveland, Ohio
WTAQ—Eau Claire, Wis.
WTAR—Norfolk, Va.
WTAW—College Station, Tex.
WTAX—Streator, Ill.
WTBO—Cumberland, Md.
WTFI—Toccoa, Ga.
WTIC—Hartford, Conn.
WTMJ—Milwaukee, Wis.
WWAE—Hammond, Ind.
WWJ—Detroit, Mich.
WWL—New Orleans, La.
WWNC—Asheville, N. C.
WWRL—Woodside, N. Y.
WWVA—Wheeling, W. Va.


SANGAMO TYPE F IMPEDANCE, LIST $5.00
E_p=180V.
2 MFD. 400 VOLT TYPE
GRID BIAS RESISTANCE 2250 OHMS TYPE B-22.5
UX-227
2 MFD.
400 VOLT TYPE
PHONOGRAPH PICK-UP MAGNETIC TYPE
6 MILLIAMPERES
1 MFD. 400 VOLT TYPE
E_g=13.5V.
SANGAMO TYPE AX AUDIO TRANSFORMER LIST $6.00
2 MFD. 400 VOLT TYPE
1 MFD. 400 VOLT TYPE
UX-250
E_p=400V.
SANGAMO TYPE "E" OUTPUT IMPEDANCE LIST $5.00
2 MFD. 800 VOLT TYPE
2 MFD. 800 VOLT TYPE
E_g=70 V.
CONNECT TO DYNAMIC SPEAKER OR EQUAL
MOVING COIL
CONE
DYNAMIC TYPE OF SPEAKER
200 OHM POTENTIOMETER SUCH AS FROST NO. 1922.
GRID BIAS RESISTANCE 1250 OHM SUCH AS ELECTRAD TYPE B-125
55 MILLIAMPERES
I_p
20 OHM POTENTIOMETER SUCH AS FROST NO. 1927 "HUM BALANCER."
TWIST ALL A.C. WIRES.
DO NOT RUN ANY A.C. WIRES NEAR GRIDS OF TUBES.
KEEP ALL OTHER WIRING APART FROM A.C. WIRES.
1. CORES OF ALL TRANSFORMERS, IMPEDANCES AND FILTER CHOKES MUST BE GROUNDED.
2. AUDIO UNITS WILL REQUIRE TURNING AROUND IN ORDER TO PICK UP MINIMUM HUM.
3. USE LINE VOLTAGE REGULATOR IF VOLTAGE GOES UP TOO HIGH.
RESISTANCE OR VOLTAGE DIVIDER = 25,000 OHM UNIT WITH ADJUSTABLE TAPS SUCH AS ELECTRAD TRUVOLT FIXED RESISTANCE TYPE D-250.
2.5 V. A.C.
7.5 V. A.C.
30 HENRY, 60 MIL. CHOKES.
500 VOLTS
500V.
215 VOLTS
45 VOLTS
1 MFD.
1 MFD.
400 VOLT TYPE
110 VOLT A.C. SUPPLY
UX-281
E=600V.
4 MFD. 800 VOLT TYPE
2 MFD. 800 VOLT TYPE
4 MFD. 800 VOLT TYPE
SWITCH
GROUND
SMALL 6 VOLT LAMP TO PROTECT UX-281
7.5 V. A.C.

Phonograph pick-up with amplifier designed to give large volume and high tone quality. The Sangamo Electric Company can furnish the audio transformers, impedances and condensers.



TONE- *sells the phonograph amplifier, too*

The exacting standards to which phonograph amplifiers must measure require manufacturers to exercise increasing care in the design of circuits and the selection of parts of *known accuracy in performance.*

Sangamo Audio Transformers are built to precision standards with electrical characteristics that will give unsurpassed reproduction when used in appropriate circuits.

The proof of transformer excellence lies in a flat performance curve. Due to the fact that the impedance of the windings of all Sangamo Audio Transformers is accurately matched to the impedances of the tubes and speakers with which they work, the Sangamo performance curve is the nearest to a straight line ever achieved by any transformers now available.

When equipped with a good phonograph pick-up and a speaker that will handle the volume output, this amplifier and power supply will give an exceptionally high quality of tone and large volume.

SANGAMO ELECTRIC CO.

SPRINGFIELD, ILLINOIS, U. S. A.
Sangamo Electric Co. of Canada, Ltd., 183 George St., Toronto, Ont.
For 30 years preeminent manufacturers of electrical precision instruments

The quality of fixed condensers affects every note and syllable

Sangamo Fixed Condensers are accurate . . . . *and stay accurate!*

MICA CONDENSER
SANGAMO
CAP .00025 MFD

Standard Type "A"
Sangamo Fixed Condenser

MICA CONDENSER
ILLINI
CAP .001 MFD

The New "Illini" Condenser
For Manufacturer's Use

COSTLY experience has brought home to many manufacturers the realization that no other item costing so little can cause as much trouble as a fixed condenser.

Not all fixed condensers are good condensers even though molded in Bakelite. Sangamo Fixed Condensers are not only rendered immune to thermal changes and mechanical damage by a Bakelite enclosure—but a soundly constructed, *accurately rated* mica condenser within the Bakelite casting assures minimum variations from rated capacities.

Sangamo precision manufacturing traditions and facilities, including one of the country's finest equipped laboratories, are responsible for Sangamo accuracy. Every Sangamo product is subjected to searching tests of the sort possible to make only in a manufacturer's laboratory. The standard line of Sangamo Fixed Condensers is tested within ten per cent of rated capacity.

The Sangamo "Illini" Condenser for manufacturer's use, is a new type of the same quality as the standard Sangamo Fixed Condenser. Its connecting lugs, which may be bent to any position required without damaging the condenser, adapt it more readily to factory production.

Mail the coupon for complete information and prices.

Pin this to your letterhead and mail

SANGAMO ELECTRIC CO., Springfield, Illinois, U.S.A.
Dept. 5421

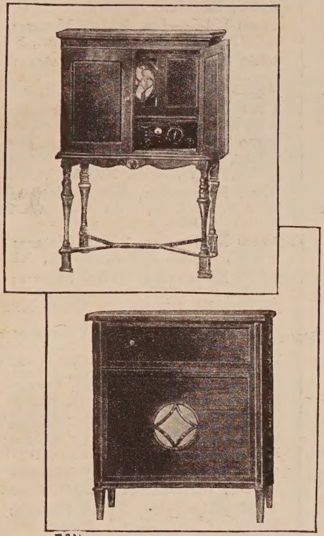
Sangamo Electric Co. of Canada, Ltd., 183 George St., Toronto

☐ (*For manufacturers*) I am interested in engineering data regarding your transformers and condensers, also the phonograph amplifier hook-up.

☐ (*For dealers*) Please send data on Sangamo Condensers.

☐ (*For set builders*) Please send booklet describing your apparatus and latest audio hook-ups. I enclose 10c to cover cost of mailing.

HERE IS THE PERFECT BROADCAST RECEIVER



The New Admiralty Super-10 is the very apex of Modern Research Engineering.

It is a brand new receiver for the radio connoisseur which we believe represents final superiority over any broadcast receiver now being manufactured or contemplated.

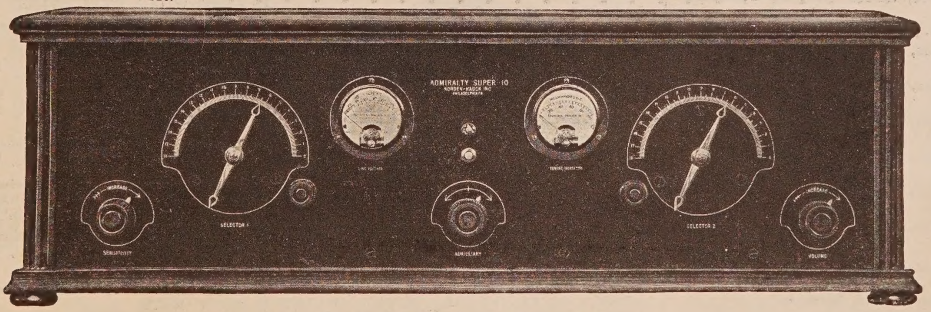
Strictly custom-built, this new model meets the requirements of those that want the best. It is, in fact, the Highest Class Receiver in the World.

SUPER FEATURES

10 Radio Tubes—Super Power—Complete self-contained electric operation—Exceedingly compact—Simplified controls—Full Vision Tuning Indicators—Uses Heater type A.C. Screen Grid and Power Tubes—Super Selective—Band Pass Filter Effect—Hum Eliminator—Line Voltage regulation—Scientifically correct shielding—Great range with sensitivity control—Minimum antenna requirements—Improved push-pull audio system—Perfect reproduction with great volume—Arranged for Electro-Dynamic Loudspeaker—Adaptable for short-wave television work—Universal wave-length range for use in any part of the world—Phonograph pickup connection—Special Weston Meters for voltage and tuning resonance—Protected against moisture for tropical and marine installation—Built strictly according to U. S. Navy Standards—Cabinets of finest selected Mahogany and Walnut Exquisite console combinations available—Entirely custom built—Thorough air test by receiving engineers on all classes of reception for range and quality of reproduction—Sold direct from factory and through selected franchise dealers in the principal cities of the United States and foreign countries—Unconditionally guaranteed against defects.

Attractive illustrated descriptive literature on request

THE NEW ADMIRALTY SUPER-10



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N. W. Cor. Delaware Avenue and South Street
Cable: NORHAUCK **Philadelphia, Pa., U. S. A.**

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550 Kilocycles, 545.1 Meters:
WEAN, WGR, WEAO, WKRC, KFUO, KSD, KFDY, KFYR, KTAB

560 Kilocycles, 535.4 Meters.
WLIT, WFI, KFDM, WNOX, WOI, KFEQ, KOAC, KLZ, WIOD

570 Kilocycles, 526.0 Meters:
WNYC, WMCA, WSYR, WMAC, WSMK, WKBN, WWNC, KGKO, WNAX, WPCC, WIBO, KUOM, KXA, KMTR.

580 Kilocycles, 516.9 Meters—Canadian Shared:
WTAG, WOBU, WSAZ, KGFX, KSAC, WSUI

590 Kilocycles, 508.2 Meters:
WEEI, WEMC, WCAJ, WOW, KHQ

600 Kilocycles, 499.7 Meters—Canadian Shared:
WTIC, WCAO, WREC, WOAN, WEBW, KFSD, KWYO, WCAC

610 Kilocycles, 491.5 Meters:
WFAN, WIP, WDAF, WOQ, KFRC

620 Kilocycles, 483.6 Meters:
WLBZ, WDBO, WDAE, WTMJ, KGW, KFAD, WJAY

630 Kilocycles, 475.9 Meters—Canadian Shared:
WMAL, WOS, KFRU, WGBF

640 Kilocycles, 468.5 Meters:
WAIU, KFI

650 Kilocycles, 461.3 Meters:
WSM

660 Kilocycles, 454.3 Meters:
WEAF, WAAW

670 Kilocycles, 447.5 Meters:
WMAQ

680 Kilocycles, 440.9 Meters:
WPTF, KPO

690 Kilocycles, 434.5 Meters—Canadian Wave:

700 Kilocycles, 428.3 Meters:
WLW

710 Kilocycles, 422.3 Meters:
WOR, KFVD

720 Kilocycles, 416.4 Meters:
WGN, WLIB

730 Kilocycles, 410.7 Meters—Canadian Wave:

740 Kilocycles, 405.2 Meters:
WSB, KMMJ

750 Kilocycles, 399.8 Meters:
WJR

760 Kilocycles, 394.5 Meters:
WJZ, WEW, KVI

770 Kilocycles, 389.4 Meters:
KFAB, WBBM, WJBT

780 Kilocycles, 384.4 Meters—Canadian Shared:
WBSO, WTAR, WPOR, KELW, KTM, WMC

790 Kilocycles, 379.5 Meters:
WGY, KGO

800 Kilocycles, 374.8 Meters:
WBAP, WFAA

810 Kilocycles, 370.2 Meters:
WPCH, WCCO

820 Kilocycles, 365.6 Meters:
WHAS

830 Kilocycles, 361.2 Meters:
KOA, WHDH

840 Kilocycles, 356.9 Meters—Canadian Wave:

850 Kilocycles, 352.7 Meters:
KWKH, WWL

860 Kilocycles, 348.6 Meters:
WBOQ, WABC, KFQZ

870 Kilocycles, 344.6 Meters:
WLS, WENR, WBCN

880 Kilocycles, 340.7 Meters—Canadian Shared:
WQAN, WGBI, WCOC, KLX, KPOF, KFKA

890 Kilocycles, 336.9 Meters—Canadian Shared:
WJAR, WMMN, WMAZ, WGST, KGJF, WILL, KUSD, KFNF, WKAQ

900 Kilocycles, 331.1 Meters:
WFBL, WMAK, WKY, WFLA, WSUN, WLBL, KHJ, KSEI, KGBU

910 Kilocycles, 329.5 Meters—Canadian Wave:

920 Kilocycles, 325.9 Meters:
WWJ, KPRC, WAAF, KOMO

930 Kilocycles, 322.4 Meters—Canadian Shared:
WIBG, WDBJ, WBRC, KGBZ, KMA, KFWM, KFWI

940 Kilocycles, 319 Meters:
WCSH, WFIW, KOIN, KGU, KFEL, KFXF WHA

950 Kilocycles, 315.6 Meters:
WRC, KMBC, KFWB, KPSN, KGHL, WHB

960 Kilocycles, 312.3 Meters—Canadian Wave:

970 Kilocycles, 309.1 Meters:
WCFL, KJR

980 Kilocycles, 305.9 Meters:
KDKA

990 Kilocycles, 302.8 Meters:
WBZ, WBZA

1000 Kilocycles, 299.8 Meters:
WHO, WOC, KPLA

1010 Kilocycles, 296.9 Meters—Canadian Shared:
WQAO, WPAP, WHN, WRNY, KGGF, WNAD, KQW

1020 Kilocycles, 293.9 Meters:
KYW, KFKX, KYWA, WRAX

1030 Kilocycles, 291.1 Meters—Canadian Wave:

1040 Kilocycles, 288.3 Meters:
WKEN, WKAR, KTHS, KRLD

1050 Kilocycles, 285.5 Meters:
KNX, KFKB

1060 Kilocycles, 282.8 Meters:
WBAL, WJAG, KWJJ

1070 Kilocycles, 280.2 Meters:
WAAT, WTAM, WEAR, WCAZ, WDZ, KJBS

1080 Kilocycles, 277.6 Meters:
WBT, WCBD, WMBI

1090 Kilocycles, 275.1 Meters:
KMOX, KFQA

1100 Kilocycles, 272.6 Meters:
WPG, WLWL, KGDM

1110 Kilocycles, 270.1 Meters:
WRVA, KSOO

1120 Kilocycles, 267.7 Meters—Canadian Shared:
WCOA, WTAW, KUT, WISN, WHAD, KFSG, KMIC, KRSC, WDEL

1130 Kilocycles, 265.3 Meters:
WOV, KSL, WJJD

1140 Kilocycles, 263.0 Meters:
WAPI, KVOO

1150 Kilocycles, 260.7 Meters:
WHAM

1160 Kilocycles, 258.5 Meters:
WWVA, WOWO

1170 Kilocycles, 256.3 Meters:
WCAU, KTNT, KEJK

1180 Kilocycles, 254.1 Meters:
WGBS, KEX, KOB, WGDY, WHDI

1190 Kilocycles, 252.0 Meters:
WICC, WOAI

1200 Kilocycles, 249.9 Meters: Canadian Shared:
WABI, WNBX, WEPS, WKBE, WIBX, WHBC, WLAP, WLBG, WNBO, WPRC, WKJC, WNBW, WABZ, WJBW, WBBY, WBBZ, WFBC, WRBL, KGCU, WJBC, WJBL, WWAE, WRAF, WMT, KFJB, WCAT, KGDY, KFWF, KFKZ, KGDE, KGFK, WCLO, WHBY, KFWC, KPPC, KXO, KMJ, KSMR, WIL, KFHA, KVOS, KGY, WMAY, KWG, KGEK, KGEW

1210 Kilocycles, 247.8 Meters—Canadian Shared:
WJBI, WGBB, WINR, WCOH, WOCL, WLCI, WPAW, WDWF, WLSI, WMAN, WJW, WEBE, WBAX, WJBU, WMBG, WSIX, WRBU, WJBY, WMBR, WRBQ, WGCM, KWEA, KDLR, KGCR, KFOR, WHBU, KFVS, WEBQ, WCRW, WEDC, WCBS, WTAX, WHBF, WIBA, WOMT, KPQ, KPCB, WSBC

1220 Kilocycles, 245.6 Meters:
WCAD, WCAE, WREN, KFKU

1230 Kilocycles, 243.8 Meters:
WNAC, WBIS, WPSC, WSBT, WFBM, KYA, KFIO, KFQD

1240 Kilocycles, 241.8 Meters:
WGHP, WJAD, WQAM, WRBC, KTAT

1250 Kilocycles, 239.9 Meters:
WGCP, WODA, WAAM, WLB, WGMS, WRHM, KFMX, WCAL, KXL, KIDO, KFOX

1260 Kilocycles, 238.0 Meters:
WLBW, WJAX, KWWG, KRGV, KOIL, KVOA

1270 Kilocycles, 236.1 Meters:
WEAI, WASH, WOOD WDSU, KWLC, KGCA, KTW, KOL, KFUM, WFBR, WJDX

1280 Kilocycles, 234.2 Meters:
WCAM, WCAP, WOAX, WDOD, WRR, WDAY, WEBC

1290 Kilocycles, 232.4 Meters:
WNBZ, WJAS, KTSA, KFUL, KLCN, KDYL

1300 Kilocycles, 230.6 Meters:
WBBR, WHAP, WEVD, WHAZ, KFH, WIBW, KGEF, KTBI, KFJR, KTBR

1310 Kilocycles, 228.9 Meters:
WKAV, WEBR, WNBH, WOL, WGH, WRK, WAGM, WFDF, WNAT, WFKD, WHBP, WFBG, WRAW, WGAL, WSAJ, WBRE, WMBL, WKBC, KGHG, WOBT, WNBJ, KRMD, KFPM, WDAH, KFPL, KFXR, WKBS, WRBI, WEHS, WCLS, WKBB, WKBI, WHFC, KWCR, KFJY, KFGQ, WBOW, WJAK, WLBC, WIBU, KFBK, KTSL, KGEZ, KFUP, KFXJ, KFBK, KGEZ, KMED, WJDZ

1320 Kilocycles, 227.1 Meters:
WADC, WSMB, KID, KGIQ, KGHF

1330 Kilocycles, 225.4 Meters:
WDRC, WTAQ, KSCJ, WSAI

1340 Kilocycles, 223.7 Meters:
WSPD, KFPW, KMO

1350 Kilocycles, 222.1 Meters:
WBNY, WMSG, WCDA, WKBQ, KWK

1360 Kilocycles, 220.4 Meters:
WLEX, WMAF, WQBC, WJKS, WGES, KFBB, KGIR, KGB

1370 Kilocycles, 218.8 Meters:
WMBO, WSVS, WCBM, WBBL, WHBD, WJBK, WIBM, WRAK, WELK, WJBO, WHBQ, WRBT, KGFG, KIT, KGCI, KGRC, KFJZ, KGKL. KFLX, WFBJ, KGDA, KZM, KRE, KGER, KFBL, KWKC, KGBX, WRJN, KGAR, KLO, KOH, KVL, KFJI, KGFL, KGGM, WHDF, KOOS, WGL, KFJM, KCRC, WJDW

1380 Kilocycles, 217.3 Meters:
WCSO, KQV, KSO, WKBH

1390 Kilocycles, 215.7 Meters:
WHK, KLRA, KUOA, KOW, KWSC, KFPY, KOY

1400 Kilocycles, 214.2 Meters:
WCGU, WSGH, WSDA, WLTH, WBBC, WCMA, WKBF, KOCW

1410 Kilocycles, 212.6 Meters:
KGRS, WDAG, KFLV, WHBL, WBCM, WSGP

1420 Kilocycles, 211.1 Meters:
WMRJ, WTBO, WSSH, WIBR, WEDH, WMBC, WKBP, WQBZ, KGFF, WHIS, KTAP, KTUE, KFYO, KICK, WIAS. KGGC, WLBF, WMBH, KGFW, KFIZ, KFXY, KGFJ, KFQU, KFXD, KGIX, KGCX, KFIF, KORE, KFWQ, KXRO, WILM, WPOE, KGIW, KGKX, WHDL, WLEY, KFQW

1430 Kilocycles, 209.7 Meters:
WBRL, WHP, WCAH, WGBC, WNBR, WBAK

1440 Kilocycles, 208.2 Meters:
WHEC, WABO, WOKO, WCBA
WNRC, WTAD, WMBD, KLS, WSAN

1450 Kilocycles, 206.8 Meters:
WBMS, WNJ, WIBS, WKBO, WSAR, WFJC, WTFI

1460 Kilocycles, 205.4 Meters:
WJSV, KSTP

1470 Kilocycles, 204.0 Meters:
WKBW, KFJF, WRUF, KGA

1480 Kilocycles, 202.6 Meters:
WJAZ, WORD, WCKY, WSOA

1490 Kilocycles, 201.6 Meters:
WBAW, WLAC, KPWF

1500 Kilocycles, 199.9 Meters:
WMBA, WLOE, WMES, WNBF, WMBQ, WLBX, WCLB, WWRL, WAFD, WKBZ, WMPC, WMBJ, WOPI, WPSW, KGHI, WRBJ, KGKB, KGDR, KGHX, WKBV, KPJM, KWBS, KWTC, KDB, KUJ, KGFI

NA-ALD

TRADE MARK
REG. U.S.A. PAT. OFF.

Whatever Your Requirements
Here Are Sockets and Adapters That
Will Meet Your Needs
Which Shall We Send You?

ADAPTERS

GROUP A—Adapters for Adapting Any Tube to Any Socket

419x	For adapting UX199 Tubes to UV201A Sockets
421x	For adapting UX Tubes to WD11 Sockets
429	For adapting UV199 Tubes to UV201A and UX Sockets
967	For adapting UV201A Tubes to UX Sockets
968	For adapting WD11 Tubes to UX Sockets
999	For adapting UX Tubes to UV199 Sockets

GROUP B—Connectoralds for Adding Power Tubes to Any Set

112	For using 112 or 171 Tubes in Battery Sets with UV201A Sockets
120	For using 120 Tubes on sets converted from UV201A to 199 Dry Cell Tubes
171	For using 112 or 171 Tubes in battery sets with UV201A or UX Sockets
420	For using 120 Tubes in sets with 199 tubes and limited headroom
920	For using 112, 120, 171 Tubes in sets with UV199 Sockets

GROUP C—Adapters for Converting Battery Sets to A. C.

926GT	(Orange) Adapter with Bypass Condensers and Y Tap Resistor for Power Tube (Red) Adapter with Bypass Condensers and Y Tap Resistor for Audio Tube
926	Adapter for UX226 Tubes with leads to Filament Prongs
927UY	Adapter for UY227 Detector Tubes with leads to Heater Prongs

GROUP D—Adapters for Electric Pickup

949	Universal for connecting Electric Pickup fitting either four or five prong tubes into grid circuit
949P	(As illustration of 949 reversed) For connecting Electric Pickup to plate circuit of A. C. or D. C. Sets.
946	For connecting Electric Pickup to plate circuit of D. C. Sets
948	For connecting Electric Pickup with plate circuit of A. C. Sets
950	For connecting Electric Pickup with grid circuit of A. C. or D. C. Sets
951	For connecting Electric Pickup with grid circuit of D. C. Sets

GROUP E—Adapters for Connecting Power Amplifiers to Any Set

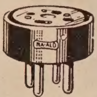
933	Adapter for attaching A. C. Sets to Power Amplifiers or Electric Phonographs
947	Recommended by Victor for connecting Radiola 16 to Electrola Power Amplifier
952	Recommended by Samson for connecting PAM Amplifiers to A. C. Sets (no R. F. Bypass Condenser)
952A	Recommended by Samson for connecting PAM Amplifiers to A. C. Sets with R. F. Bypass condenser
953A	Recommended by Samson for connecting PAM Amplifiers to D. C. Sets with R. F. Bypass Condenser
953	Recommended by Samson for connecting PAM Amplifiers to D. C. Sets (no R. F. Bypass Condenser)

GROUP A

419X

421X

429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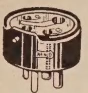
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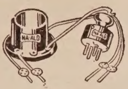
999

GROUP B

112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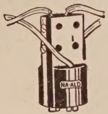
120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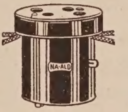
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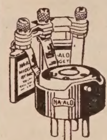
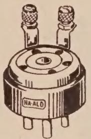
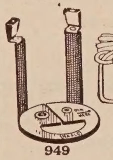
GROUP C


926GT

926


927UY

GROUP D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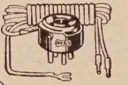
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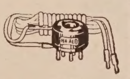
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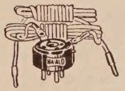
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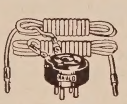
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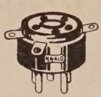
GROUP E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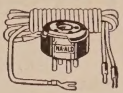
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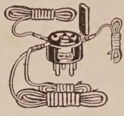
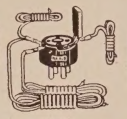
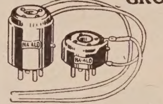

952A


953A

953

GROUP F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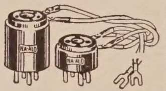
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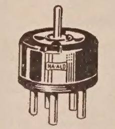
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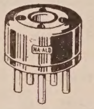
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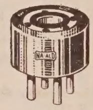
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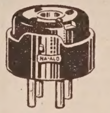
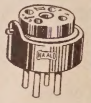
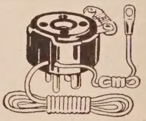
GROUP G


944E

955E

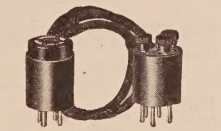

921S

934


922

GROUP F—Adapters Especially for Set Analyzers and Testing Equipment

932	Twin Adapter for testing UX222 Shielded Grid Tubes in Jewell Testers
942	Twin Adapters for testing 5 prong A. C. Tubes in Jewell Testers
957	Weston 4 hole, 5 prong Adapter with top center stud
958	Weston 5 hole 4 prong Adapter with extra center prong
945	For adapting 4 prong UX Tubes to 5 prong UY Sockets
954	For adapting 5 prong UY Tubes to 4 prong UX Sockets


Special Adapter Made for Victor

GROUP G—Miscellaneous Adapters

944E	4 hole, 4 rong adapter ⅞ inches high with all connections through
944	(Not illustrated) as 944E except ⅝ inches high
955E	5 hole, 5 prong adapter ⅞ inches with all connections through
955	(Not illustrated) as 955E except ⅝ inches high
921s	For cushioning microphonic tubes in either UX or UV201A Sockets
934	Adapter with grid resistor for oscillation control
922	For adapting any socket for UX222 Shielded Grid Tube

SOCKETS

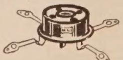
400	DeLuxe Socket with neck and slot for Bayonet Pin
422	NA-ALD Small Space 4 prong Socket for below panel soldering
423	NA-ALD Small Space 5 prong Socket for below panel soldering
424	NA-ALD 4 prong Socket with 2 mounting holes for above or below panel mounting, below panel soldering
425	NA-ALD 5 prong Socket with 2 mounting holes for above or below panel mounting, below panel soldering

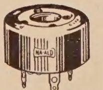
SOCKETS

426	NA-ALD 4 prong A. C. Socket, UX type, with contacts for above panel soldering
427	NA-ALD 5 prong A. C. Socket, UX type, with contacts for above panel soldering
428	NA-ALD 4 prong Small Space Socket especially for Rectifier Tubes, for above panel soldering
481XS	NA-ALD 4 prong Microphone Socket with mounting base
482S	NA-ALD 4 prong Microphone Socket for direct panel mounting

Dept. C ALDEN MANUFACTURING CO. Brockton, Mass.

400


482S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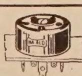

423

424

425

426

427

428

481SX

U. S. Broadcasting Stations Listed by States

ALABAMA

Birmingham, WBRC, WKBC, WAPI
Gadsden, WJBY

ALASKA

Anchorage, KFQD
Ketchikan, KGBU

ARIZONA

Flagstaff, KFXY
Phoenix, KFAD, KOY
Prescott, KPJM
Tuscon, KGAR, KVOA

ARKANSAS

Blytheville, KLCN
Fayetteville, KUOA
Hot Springs, KTHS
Little Rock, KLRA, KGHI, KGJF
McGehee, KGHG
Siloam Springs, KFPW

CALIFORNIA

Berkeley, KRE
Beverley Hills, KEJK
Burkank, KELW
Culver City, KFVD
El Centro, KXO
Fresno, KMJ
Hayward, KZM
Hollywood, KFQZ, KMTR, KNX, KFWB
Holy City, KFQU
Inglewood, KMIC
Long Beach, KFOX, KGER
Los Angeles, KFI, KFSG, KGEF, KGFJ, KHJ, KPLA, KTBI
Oakland, KFWM, KGO, KLS, KLX, KTAB
Ontario, KFWC
Pasadena, KPPC, KPSN
Sacramento, KFBK
San Diego, KFSD, KGB
San Francisco, KFRC, KFWI, KJBS, KPO, KGGC, KYA
San Jose, KQW
Santa Ana, KWTC
Santa Barbara, KDB
Santa Maria, KSMR
Santa Monica, KTM
Stockton, KGDM, KWG
Westminster, KPWF

COLORADO

Colorado Springs, KFUM
Denver, KFEL, KFUP, KFXF, KOA, KPOF
Dupont, KLZ
Edgewater, KFXJ
Fort Morgan, KGEW
Greeley, KFKA
Gunnison, KFHA
Pueblo, KGHF
Trinidad, KGIW
Yuma, KGEK

CONNECTICUT

Bridgeport, WICC
Hartford, WTIC
New Haven, WDRC
Storrs, WCAC

DELAWARE

Wilmington, WDEL, WILM

DISTRICT OF COLUMBIA

Washington, NAA, WMAL, WRC, WOL

FLORIDA

Clearwater, WFLA, WSUN
Gainesville, WRUF
Jacksonville, WJAX
Lakeland, WMBL
Miami Beach, WIOD, WQAM
Orlando, WDBO
Pensacola, WCOA
Tampa, WDAE, WMBR,

GEORGIA

Atlanta, WGST, WSB
Columbus, WRBL
Macon, WMAZ
Savannah, WSGP
Tifton, WRBI
Toccoa, WTFI

HAWAII

Honolulu, KGU

IDAHO

Boise, KIDO
Idaho Falls, KID
Jerome, KFXD
Pocatello, KSEI
Sandpoint, KGKX
Twin Falls, KGIQ

ILLINOIS

Carthage, WCAZ
Chicago, KYW, WAAF, WCFL, WCRW, WEDC, WENR, WGES, WKBI, WPCC, WGN, WMAQ, WMBI, WBBM, KYWA, WSBC, WBCN, WIBO, WJAZ, WJBT, WLIB, WLS, WORD, KFKX
Cicero, WHFC
Decatur, WJBL
Evanston, WEHS
Forest Park, WSOA
Galesburg, WKBS
Harrisburg, WEBQ
Joliet, WCLS, WKBB
La Salle, WJBC
Mooseheart, WJJD
Peoria Heights, WMBD
Quincy, WTAD
Rockford, KFLV
Rock Island, WHBF
Springfield, WCBS
Streator, WTAX,
Tuscola, WDZ
Urbana, WILL
Zion, WCBD

INDIANA

Anderson, WHBU,
Brookville, WKBV
Culver, WCMA
Evansville, WGBF
Fort Wayne, WGL, WOWO
Gary, WJKS
Hammond, WWAE
Indianapolis, WFBM, WKBF
La Porte, WRAF
Marion, WJAK
Muncie, WLBC
South Bend, WSBT
Terre Haute, WBOW
Valparaiso, WRBC

IOWA

Ames, WOI
Boone, KFGQ
Cedar Rapids, KWCR
Clarinda, KSO,
Council Bluffs, KOIL
Davenport, WOC
Decorah, KGCA, KWLO
Des Moines, WHO,
Ft. Dodge, KFJY
Iowa City, WSUI
Marshalltown, KFJB
Muscatine, KTNT
Ottumwa, WIAS
Red Oak, KICK
Shenandoah, KFNF, KMA
Sioux City, KSCJ
Waterloo, WMT

KANSAS

Kansas City, WLBF
Lawrence, KFKU, WREN
Manhattan, KSAC
Milford, KFKB
Topeka, WIBW
Wichita, KFH

KENTUCKY

Covington, WCKY
Hopkinsville, WFIW
Louisville, WHAS, WLAP

LOUISIANA

Cedar Grove, KGGH
Kennonwood, KWKH
New Orleans, WABZ, WCBE, WJBO, WJBW, WSMB, WWL, WDSU
Shreveport, KTSL, KWEA, KRMD

MAINE

Bangor, WABI, WLBZ
Portland, WCSH

MARYLAND

Baltimore, WCAO, WCBM, WBAL, WFBR
Cumberland, WTBO

MASSACHUSETTS

Boston, WBZA, WEEI, WNAC, WSSH, WMES, WBIS,
Dartmouth, WMAF
Springfield, WBZ
Fall River, WSAR
Gloucester, WEPS, WHDH
Lexington, WLEX, WLEY
New Bedford, WNBH
Webster, WKBE
Wellesley Hills, WBSO
Worcester, WTAG

MICHIGAN

Battle Creek, WKBP
Bay City, WBCM
Berrien Springs, WEMC
Calumet, WHDF
Detroit, WAFD, WMBC, WWJ, WJR, WGHP
East Lansing, WKAR
Flint, WFDF
Grand Rapids, WASH, WOOD
Jackson, WIBM
Lapeer, WMPC
Ludington, WKBZ
Royal Oak, WAGM
Ypsilanti, WJBK

MINNESOTA

Anoka, WCCO
Collegeville, WFBJ
Duluth, WEBC
Fergus Falls, KGDE
Hallock, KGFK
Minneapolis, WDGY, WHDI, WLB, WRHM, WCCO, WGMS
Northfield, KFMX, WCAL
St. Paul, KSTP

MISSISSIPPI

Columbus, WCOC
Greenville, WRBQ
Gulfport, WGCM
Hattiesburg, WRBJ
Jackson, WJDX
Utica, WQBC

MISSOURI

Cape Girardeau, KFVS
Columbia, KFRU
Independence, KMBC
Jefferson City, WOS
Joplin, WMBH
Kansas City, KWKC, WDAF, WOQ, WHB
Kirksville, KFKZ
St. Joseph, KGBX, KFEQ
St. Louis, KFWF, KSD, KWK, WEW, WIL, KMOX, KFUO, WMAY, KFQA

MONTANA

Billings, KGHL
Butte, KGIR
Havre, KFBB
Kalispell, KGEZ
Missoula, KUOM
Vida, KGCX

NEBRASKA

Clay Center, KMMJ
Lincoln, KFAB, KFOR, WCAJ
Norfolk, WJAG
Omaha, WAAW, WOW
Ravenna, KGFW
York, KGBZ

NEVADA

Reno, KOH

NEW HAMPSHIRE

Laconia, WKAV
Tilton, WBRL

NEW JERSEY

Asbury Park, WCAP
Atlantic City, WPG
Camden, WCAM
Elizabeth, WIBS
Fort Lee, WBMS
Jersey City, WAAT, WKBO
Newark, WAAM, WGCP, WNJ, WOR
Paterson, WODA
Red Bank, WJBI
Trenton, WOAX

NEW MEXICO

Albuquerque, KGGM
Las Vegas, KGIX
Raton, KGFL
State College, KOB

NEW YORK

Auburn, WMBO
Bay Shore, WINR
Binghamton, WNBF
Brooklyn, WBBC, WLTH, WMBQ, WSGH, WSDA
Buffalo, WEBR, WGR, WKBW, WKEN, WSVS, WMAK
Canton, WCAD
Cazenovia, WMAC
Coney Island, WCGU
Freeport, WGBB
Ithaca, WLCI, WEAI
Jamaica, WMRJ
Jamestown, WOCL
Long Beach, WCLB
Long Island City, WLBX
New York, WBNY, WHN, WJZ, WKBQ, WMCA, WMSG, WNYC, WPCH, WRNY, WABC, WOV, WQAO, WLWL, WBOQ, WCDA, WEAF, WEVD, WGBS, WHAP, WPAP
Patchogue, WPOE
Rochester, WHAM, WHEC
Rossville, WBBR
Saranac Lake, WNBZ
Schenectady, WGY
Syracuse, WFBL, WSYR
Troy, WHAZ
Tupper Lake, WHDL
Utica, WIBX
Woodhaven, WEVD
Woodside, WWRL
Yonkers, WCOH

NORTH CAROLINA

Asheville, WWNC
Charlotte, WBT
Gastonia, WRBU
Greensboro, WNRC
Raleigh, WPTF
Wilmington, WRBT
Winston-Salem, WJDZ

NORTH DAKOTA

Bismarck, KFYR
Devils Lake, KDLR
Fargo, WDAY
Grand Forks, KFJM
Mandan, KGCU

OHIO

Akron, WADC, WFJC
Bellefontaine, WHBD
Canton, WHBC
Cambridge, WEBE
Cincinnati, WKRC
Cleveland, WEAR, WHK, WJAY, WTAM
Columbus, WAIU, WCAH, WEAO, WMAN
Dayton, WSMK
Hamilton, WRK
Mansfield, WJW
Mason, WSAI, WLW
Middleton, WSRO
Springfield, WCSO
Steubenville, WIBR
Toledo, WSPD
Youngstown, WKBN

OKLAHOMA

Alva, KGFF
Chickasha, KOCW
Enid, KCRC
Norman, WNAD
Oklahoma City, KFJF, KFXR, KGCB, KGFG, WKY
Picher, KGGF
Ponca City, WBBZ
Tulsa, KVOO

OREGON

Astoria, KFJI
Corvallis, KOAC
Eugene, KORE
Marshfield, KOOS
Medford, KMED
Portland, KEX, KOIN, KFIF, KFJR, KGW, KTBR, KWBS, KWJJ, KXL

PENNSYLVANIA

Allentown, WCBA, WSAN
Altoona, WFBG
Carbondale, WNBW
East Pittsburgh, KDKA
Elkins Park, WIBG
Erie, WEDH, WRAK
Frankford, WFKD
Grove City, WSAJ
Harrisburg, WRAK, WPRC
Johnstown, WHBP
Lancaster, WGAL, WKJC
Le Moyne, WHP
Lewisburg, WJBU
Oil City, WLBW
Philadelphia, WCAU, WFI, WIP, WLIT, WNAT, WRAX, WPSW, WFAN, WELK
Pittsburgh, KQV, WCAE, WJAS
Reading, WRAW
Scranton, WGBI, WQAN,
State College, WPSC
Wilkes-Barre, WBAX, WBRE
Wilkensburg, WMBJ
Washington, WNBO

PORTO RICO

San Juan, WKAQ

RHODE ISLAND

Cranston, WDWF
Newport, WMBA
Pawtucket, WPAW
Providence, WEAN, WJAR

SOUTH CAROLINA

Charleston, WBBY

SOUTH DAKOTA

Brookings, KFDY, KGCR
Dell Rapids, KGDA
Oldham, KGDY
Pierre, KGFX
Rapid City, WCAT
Sioux Falls, KSOO
Vermillion, KUSD
Watertown, KGCR
Yankton, WNAX

TENNESSEE

Bristol, WOPI
Chattanooga, WDOD
Knoxville, WFBC, WNBJ, WNOX
Lawrenceburg, WOAN
Memphis, WGBC, WHBQ, WMC, WNBR
Nashville, WBAW, WLAC, WSM
Springfield, WSIX
Union City, WOBT
Whitehaven, WREC

TEXAS

Abilene, KFYO
Amarillo, KGRS, WDAG
Austin, KUT
Beaumont, KFDM
Brownsville, KWWG
Brownwood, KGKB
College Station, WTAW
Corpus Christi, KGFI
Dallas, KRLD, WFAA, WRR
Dublin, KFPL
El Paso, WDAH
Forth Worth, KFJZ, WBAP, KTAT
Galveston, KFLX, KFUL
Greenville, KFPM
Harlingen, KRGV
Houston, KPRC, KTUE
Richmond, KGHX
San Angelo, KGFI, KGKL
San Antonio, KGDR, KGRC, KTAP, KTSA, WOAI
Waco, WJAD
Wichita Falls, KGKO

UTAH

Ogden, KLO
Salt Lake City, KDYL, KSL

VERMONT

Springfield, WNBX

VIRGINIA

Arlington, NAA
Emory, WJDW
Mt. Vernon Hills, WJSV
Newport News, WGH
Norfolk, WTAR, WPOR
Petersburg, WLBG
Richmond, WBBL, WMBG, WRVA
Roanoke, WDBJ

WASHINGTON

Aberdeen, KXRO
Bellingham, KVOS
Everett, KFBL
Lacey, KGY
Longview, KUJ
Pullman, KWSC
Seattle, KOL, KFQW, KPQ, KJR, KOMO, KPCB, KRSC KTW, KVL, KXA
Spokane, KFIO, KFPY, KGA, KHQ
Tacoma, KMO, KVI
Yakima, KIT

WEST VIRGINIA

Bluefield, WHIS
Charleston, WOBU
Fairmont, WMMN
Huntington, WSAZ
Wheeling, WWVA
Wierton, WQBZ

WISCONSIN

Beloit, WEBW
Eau Claire, WTAQ
Fond Du Lac, KFIZ
Kenosha, WCLO
La Crosse, WKBH
Madison, WHA, WIBA
Manitowac, WOMT
Milwaukee, WHAD, WISN, WTMJ
Poynette, WIBU
Racine, WRJN
Sheboygan, WHBL
Stevens Point, WLBL
West De Pere, WHBY

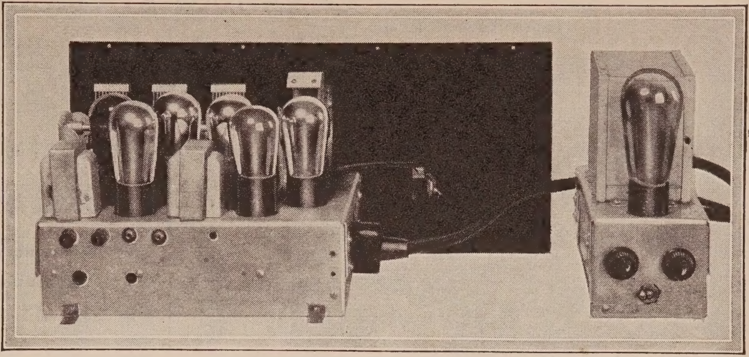
WYOMING

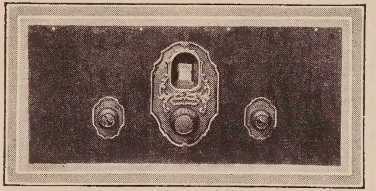
Laramie, KWYO

Order Your Complete Parts for KEYSTONE Electric 67 RADIO

Including completely wired Power Pack

AS DESCRIBED IN THIS ISSUE





A Big Opportunity for Custom Set Builders

THE Keystone Electric 67 Radio offers an unusual opportunity for custom set builders. Here is a complete modern set that can be quickly constructed at a very low cost and still enable the builder to make a good profit and sell it below other similar sets on the market. The parts are all good, standard makes and the circuit is a tried and proved one, 6 tubes and a 280 rectifier tube are used, 1—227 tube, 1—171 tube and 4—226 tubes. The complete built-in power pack operated by a 280 rectifier tube contains a switch and 2 knobs; the purpose of the switch is to adjust the set to your particular line voltage; if the line voltage is 115 volts and up turn it to the right, if it is 105 to 110 volts turn it to the left. The two knobs turn the hum switch enabling you to tune out the hum entirely.

Latest Design—Low Cost

Where the custom set-builder desires a circuit of the latest design and one that will operate under the most trying conditions and a set that is superior in selectivity, and one that can reach out and get long distance stations, here is the set to build. The low cost of the equipment, enables you to sell it at a price under any on the market of a similar quality. You can make money with the Keystone Electric 67 Radio. Build one now and you will be so satisfied that you will want many others.

Easy for Anyone to Build

The Keystone Electric 67 Radio set is one of the easiest of sets to build. The construction is of approved design—and yet economical and efficient. Power pack is completely wired, ready for use.

It is easy for any one to build this simple set and its low price affords an unusual opportunity for the set builder to get back into the game, building up-to-date A. C. radio sets for those who have been getting along without them.

Order Direct from This Advertisement

At the panel to the right is shown the complete parts and list price of the parts officially selected and prescribed by the laboratory. These complete parts will be sent to you at the special low price quoted. Use the handy coupon to the right in sending in your order. Prompt shipment will be made as soon as received by us. If you send remittance with order goods will be sent to you prepaid anywhere in the U. S. A.; if sent C. O. D. you are to pay charges. Order the complete set of parts now and be the first to build this exceptional circuit.

The Barawik Co.

39-B Canal Station
Chicago, U. S. A.

$29.95

Parts for Kit

1 Centralab Variable resistor 3000 ohm
1 3 meg. grid leak
1 ½-½ mfg. bypass cond. with filter 1 mfg. cond. attached
1 3000 ohm heavy duty resistor
1 3000 ohm flexible resistor
1 3 gang variable cond.
2 audio transformers
1 audio choke
1 50 ohm centertapped resistor
1 .002 condenser
1 .00025 condenser
2 500 ohm grid suppressors
1 Jones multi-plug complete or bakelite connecting strip
3 radio frequency coils with strip
1 dial
1 dial plate
1 panel with escutcheon plates
1 AC switch
2 small knobs
1 large knob
1 roll hook-up wire
1 length spaghetti tubing
2 binding posts
2 tip jacks
1 pilot light with socket
1 chassis with sockets ready for wiring
1 power pack completely wired ready for use
Insulating washers, solder, nuts and screws
2 small brackets

List price, complete parts, $60.00. Our special low net price,

$29.95

Special prices on tubes, cabinets, speakers and accessories. Write for catalog.

MAIL THIS COUPON NOW

BARAWIK CO., 39-B Canal Sta.,
Chicago, U. S. A.

Dear Sirs:

Please send complete kit of parts for the Keystone Electric 67 Radio Set as shown in Call Book, at your special advertised price.

( ) Remittance of......enclosed. ( ) Send C.O.D.

( ) Also send your big new catalog and encyclopedia for 1929-30.

Name..

St. & No..

City.............................State..................

CRCB-929

CANADIAN STATIONS

PRINCE EDWARD ISLAND

Call		Wave	Power
CFCY	Island Radio Co., Charlottetown	312.3	100
CHCK	W. E. Burke, Charlottetown	312.3	30
CHGS	R. T. Holman, Ltd., Summerside	267.7	25

QUEBEC

Call		Wave	Power
CFCF	Canadian Marconi Co., Montreal	410.7	650
CHRC	E. Fontaine, Quebec	340.7	5
CHYC	Northern Electric Co., Ltd., Montreal	410.7	750
CKAC	La Presse Publishing Co., Montreal	410.7	1200
CKCI	Le "Soleil," Ltd., Quebec	340.7	22 ½
CKCV	G. A. Vandry, Quebec	340.7	50
CKSH	City of St. Hyacinthe, St. Hyacinthe	296.9	50
CNRM	Canadian National Railways, Montreal	410.7	1650
CNRQ	Canadian National Railways, Quebec	340.7	50

SASKATCHEWAN

Call		Wave	Power
CFQC	The Electric Shop, Saskatoon	329.5	500
CHWC	R. H. Williams & Sons, Regina	312.3	15
CJBR	Saskatchewan Co-op. Wheat Producers, Ltd., Regina	312.3	500
CJGX	Winnipeg Grain Exchange, Yorkton	475.9	500
CJHS	Radio Service, Ltd., Saskatoon	329.5	250
CJRM	James Richardson & Sons, Ltd., Moose Jaw	296.9	500
CJRW	James Richardson & Sons, Ltd., Fleming	296.9	500
CNRR	Canadian National Railways, Regina	312.3	500
CKCK	Leader Publishing Co., Ltd., Regina	312.3	500
CNRS	Canadian National Railways, Saskatoon	329.5	500

ALBERTA

Call		Wave	Power
CFAC	Calgary Herald, Calgary	434.5	500
CKCN	W. W. Grant, Ltd., Calgary	434.5	1800
CHCA	Albertan Publishing Co., Calgary	434.5	250
CJCJ	Radio Service & Repair Shop, Calgary	434.5	250
CHCT	G. F. Tull & Arden, Ltd., Red Deer	356.9	1000
CKLC	Alberta Pacific Grain Co., Red Deer	356.9	1000
CHMA	Christian & Missionary Alliance, Edmonton	516.9	250
CJCA	Edmonton Journal, Ltd., Edmonton	516.9	500
CJOC	J. E. Palmer, Lethbridge	267.7	50
CKUA	University of Alberta, Edmonton	516.9	500
CNRC	Canadian National Railways, Calgary	434.5	500
CNRE	Canadian National Railways, Edmonton	516.9	500

BRITISH COLUMBIA

Call		Wave	Power
CFCT	Victoria Broadcasting Assn., Victoria	475.9	500
CFJC	N. S. Dalgleish & Sons, Kamloops	267.7	15
CHLS	W. G. Hassell, Vancouver	410.7	50
CKCD	Daily Province, Vancouver	410.7	50
CHWK	Chilliwack Broadcast Co., Chilliwack	247.8	5
CJOR	G. C. Chandler, Sea Island	291.1	50
CKFC	United Church of Canada, Vancouver	410.7	50
CKMO	Sprott-Shaw Radio, Vancouver	410.7	50
CKWX	A. Holstead & Wm. Hanlon, Vancouver	410.7	100
CNRV	Canadian National Railways, Vancouver	291.1	500

MANITOBA

Call		Wave	Power
CKY	Manitoba Telephone System, Winnipeg	384.4	500
CNRW	Canadian National Railways, Winnipeg	384.4	500

NEW BRUNSWICK

Call		Wave	Power
CFBO	C. A. Munro, Ltd., St. John	336.9	50
CFNB	James S. Neill & Sons, Ltd., Fredericton	247.8	100
CNRA	Canadian National Railways, Moncton	475.9	500

NOVA SCOTIA

Call		Wave	Power
CHNS	Northern Electric Co., Ltd., Halifax	322.4	100
CHNS	Halifax Herald, Halifax	322.4	500

ONTARIO

Call		Wave	Power
CFCA	Star Publishing & Printing Co., Toronto	356.9	500
CFCH	Abitibi Power & Paper Co., Ltd., Iroquois Falls	499.7	250
CFLC	Radio Association of Prescott, Prescott	296.9	50
CFMC	Monarch Battery Co., Kingston	267.7	20
CFRB	Standard Radio Mfg. Corp., Ltd., King	312.3	1000
CFRC	Queens University, Kingston	267.7	500
CHCS	Hamilton Spectator, Hamilton	340.7	10
CHML	Maple Leaf Radio Co., Ltd., Mt. Hamilton	340.7	50
CHNC	Toronto Radio Research Society, Toronto	516.9	500
CKNC	Canadian National Carbon Co., Toronto	516.9	500
CJBC	Jarvis Street Baptist Church, Toronto	516.9	500
CJGC	Free Press Printing Co., Ltd., London	329.5	500
CJSC	Evening Telegram, Toronto	516.9	500
CKCL	Dominion Battery Co., Toronto	516.9	500
CKCO	Ottawa Radio Assn., Ottawa	434.5	100
CKCR	John Patterson, Brantford	296.9	50
CKGW	Gooderham & Worts, Bowmanville	312.3	5000
CKMC	R. L. MacAdam, Cobault	247.8	15
CKOC	Wenworth Radio & Auto Supply Co., Ltd., Hamilton	340.7	100
CKOW	Nestle's Food Co. of Canada, Toronto	356.9	500
CKPC	Wallace Russ, Preston	247.8	25
CKPR	E. O. Swam, Midland	267.7	50
CNRO	Canadian National Railways, Ottawa	434.5	500
CNRT	Canadian National Railways, Toronto	356.9	500

SHORT WAVE PHONE AND TELEGRAPH STATIONS

109.0	2XK, Schenectady, N. Y.
107.1	KIU, Guadalupe, Calif.
105.0	6XBR-KFWB, Los Angeles, Calif.
100.0	2XI, Schenectady, N. Y.
65.4	2XAQ-WOR, Newark, N. J.
63.66	KDKA, East Pittsburgh, Pa.
58.75	KDKA, East Pittsburgh, Pa.
58.5	2XE, Richmond Hill, N. Y.
52.02	8XAL-WLW, Harrison, Ohio.
42.95	KDKA, East Pittsburgh, Pa.
40.0	6XBR-KFWB, Los Angeles, Calif.
37.24	WCFL, Chicago, Ill.
35.0	WGY, Schenectady, N. Y.
35.0	2XI, Schenectady, N. Y.
31.48	2XAF-WGY, Schenectady, N. Y.
30.91	2XAL-WRNY, Coyotesville, N. J.
30.0	2XI, Schenectady, N. Y.
26.78	KDKA, East Pittsburgh, Penn.
26.0	KDKA, East Pittsburgh, Pa.
22.8	WOWO, Ft. Wayne, Ind. (phone).
21.96	WXO, Schenectady, N. Y.
20.0	2XAW, Schenectady, N. Y.
19.56	2XAD, Schenectady, N. Y.
18.3	WBQ, Schenectady, N. Y.
15.0	2XAW, Schenectady, N. Y.

SHORT WAVE TELEVISION STATIONS

Call	Kilocycles	Meters	Owner	Apertures
W1XAE	2000-2100	145	Westinghouse Elec. Co., Springfield, Mass.	....
W1XAY	2000-2100	145	Lexington Air Station, Lexington, Mass.	48
W2XBA	2750-2850	107	WAAM, Inc., Newark, N. J.	....
W2XBS	2000-2100	145	R. C. C., New York, N. Y.	60
W2XBU	2000-2100	145	H. E. Smith, Mt. Beacon, N. Y.	48
W2XBV	2100-2200	139	R. C. A., New York, N. Y.	....
W2XBW	2000-2100	145	R. C. A., New York, N. Y.	....
W2XCL	2000-2100	145	Pilot Electric Co., Brooklyn, N. Y.	....
W2XCL	2750-2850	107	Pilot Electric Co., Brooklyn, N. Y.	....
W2XCP	2000-2100	145	Freed Eiseman Radio Corp., New York City	....
W2XCP	2850-2950	103	Freed Eiseman Radio Corp., New York City	....
W2XCR	2100-2200	139	Jenkins Television Corp., Jersey City, N. J.	48
W2XCW	2100-2200	139	General Electric Co., Schenectady, N. Y.	24
W3XK	2850-2950	103	C. F. Jenkins, Washington, D. C.	48
W4XE	2000-2100	145	W. J. Lee, Winter Park, Fla.	....
W6XN	2000-2100	145	General Electric Co., Oakland, Cal.	....
W8XAV	2100-2200	139	Westinghouse Elec. Co., Pittsburgh, Pa.	60
W8XAV	2750-2850	107	Westinghouse Elec. Co., Pittsburgh, Pa.	60
W8XAV	2000-2100	145	Westinghouse Elec. Co., Pittsburgh, Pa.	60
W9XAA	2000-2100	145	Federation of Labor, Chicago, Ill.	48
W9XAG	2100-2200	139	Aero Products, Inc., Chicago, Ill.	....
W9XR	2850-2950	103	Great Lakes Broadcasting Co., Chicago, Ill.	24

FOREIGN BROADCAST STATIONS

(Much of the data here shown is supplied by the Bureau of Foreign and Domestic Commerce Division of the Department of Commerce)

ARGENTINA

Call		Wave
LOZ	Buenos Aires	330
LOS	Buenos Aires	291.2
LON	Buenos Aires	210
LOR	Buenos Aires	344.8
LOV	Buenos Aires	361
LOY	Buenos Aires	315.8
LOX	Buenos Aires	380
LOQ	Buenos Aires	261
LOO	Buenos Aires	252
LOJ	Buenos Aires	270
LOW	Buenos Aires	303
LOT	Buenos Aires	400
LOL	Buenos Aires	236
D3	Buenos Aires	253.3
B2	Buenos Aires	275
H5	Cordova	275
H6	Cordova	250
LOP	La Plata	425
LOU	Mendoza	380
M6	Mendoza	348
F2	Rosaria	270
F1	Santa Fe	279

AUSTRALIA

Call		Wave
5CL	Adelaide	395
5DN	Adelaide	313
5KA	Adelaide	250
2MK	Bathurst	275
4QG	Brisbane	385
7ZL	Hobart	516
3AR	Melbourne	484
3LO	Melbourne	32
3LO	Melbourne	371
3UZ	Melbourne	319
3DB	Melbourne	255
2HD	Newcastle	288
6AG	Perth	32.9
2FC	Sydney	28.5
2KY	Sydney	280
2FC	Sydney	442
2BL	Sydney	353
2BL	Sydney	32.5
2ME	Sydney	28.5
2EC	Sydney	442
2GB	Sydney	326
2UE	Sydney	293
2UW	Sydney	267
4GR	Toowoomba	294

AUSTRIA

Call		Wave
	Graz	365.8
	Innsbruck	294.1
	Klagenfurt	272.7
	Linz	254.2
	Vienna	577
ORV	Vienna	516.4
	Vienna	22.2
OHK2	Vienna	70
EATH	Vienna	37

AFRICA (NORTH AND EAST)

Call		Wave
8DB	Algiers	310
SRE	Cairo	255
TNV	Carthage	1850
CNO	Casablanca	250
AIN	Casablanca	51
8KR	Constantine	42.8
	Narobi	90
	Rabat	416
TUA	Tunis	1450

AFRICA (SOUTH)

Call		Wave
ZTC	Capetown	372
ZTD	Durban	398
ZTJ	Johannesburg	443.5
ZTJ	Johannesburg	32
	Pretoria	323

BELGIUM

Call		Wave
	Antwerp	265.5
BAV	Brussels	512
	Ghent	275
	Liege	205
	Liege	294.1
LOAA	Luxembourg	217.4

BOLIVIA

Call		Wave
	La Paz	175
	La Paz	300

BRAZIL

Call		Wave
SQAD	Bahia	445
SQAF	Curytiba	340
SQAY	Juiz de Fora	380
	Pernambuco	310
SQAK	Ribeirao Preto	350
SQAB	Rio de Janeiro	320
SQAJ	Rio de Janeiro	260
SQAA	Rio de Janeiro	400
SQAI	Santos	280
SQBO	Sao Paulo	225.4
SQAG	Sao Paulo	360
	Sorocaba	425

CHILE

Call		Wave
CMAI	Concepcion	345
CMAC	Sanitago	360
CMAD	Santiago	320
CMAE	Santiago	280
CMAT	Tacna	550
CMAK	Temuco	245

CHINA

Call		Wave
COHB	Harbin	435
COMK	Mukden	425
KRC	Shanghai	338
COTN	Tientsin	480
GEC	Tientsin	280
VPS3	Victoria	800

CHOSEN

Call		Wave
JODK	Seoul	357

CUBA

Call		Wave
6EV	Caibarien	250
7AZ	Camaguey	225
7EV	Camaguey	190
7GT	Camaguey	195
7LO	Camaguey	230
6YR	Camajuani	200
8KP	Caney	180
8LC	Caney	300
7BY	Ciego de Avila	235
7FU	Ciego de Avila	200
7HF	Ciego de Avila	192
7IR	Ciego de Avila	193
6BY	Cienfuegos	260
6JQ	Cienfuegos	275
6KC	Cienfuegos	240
5EV	Colon	360
7SR	Elia	350
1AZ	Guanajoy	275
2LC	Havana	303
CMC	Havana	357
2AB	Havana	200
2BB	Havana	250
2CC	Havana	350
2CT	Havana	200
2GF	Havana	192
2MA	Havana	215
2MG	Havana	284
2MU	Havana	265
2OK	Havana	350
2OL	Havana	257
2RK	Havana	315
2TW	Havana	270
2UF	Havana	275

Call		Wave
2XX	Havana	225
6RG	Havana	200
2FG	Hershey	200
2JF	Mariana	245
2JL	Mariana	294
5DW	Matanzas	270
6HS	Sagua la Grande	200
6KP	Sancti Spiritus	195
8HS	Santiago	200
8DY	Santiago	250
8FU	Santiago	225
8IR	Santiago	190
8JQ	Santiago	130
6XJ	Tuinucu	278
6KW	Tuinucu	340

CZECHOSLOVAKIA

OKR	Bratislava	300
OKB	Brunn	342
	Kosice	263
	Kosice	1870
OKP	Prague	487

DENMARK

D7RL	Copenhagen	84.25
D7MK	Copenhagen	32.05
	Copenhagen	281
	Kalundborg	1153
	Ryvang	1150
	Soro	1153.8

ESTONIA

	Tallinn	408
	Tallinn	1200

FINLAND

	Bjorneborg	254.2
	Helsingfors	500
	Helsingfors	375
	Helsingfors	240
	Jacobstad	275.2
	Lahti	1800
	Lahti	318
	Mikeli	566
	Tammerfors	400
	Uleaborg	250
	Viborg	240

FRANCE

2BD	Agen	297
	Agen	30.75
	Beziers	158
	Bordeaux	258
PTT	Bordeaux	275
	Fecamp	200
	Grenoble	416
	Juan les Pins	246
	Limoges	285
	Lille	264
	Lyons	291
YR	Lyons	40.2
PTT	Lyons	480
	Marseilles	303
	Monte de Marzan	390
	Montpelier	238
	Nancy	15.5
	Nimes	240
F8AV	Nogent sur Seine	80
	Paris	1750
	Paris	308
FL	Paris	2650
FL	Paris	1444
CFR	Paris	1725
FPTT	Paris	458
	Paris	350
	Paris	340.9
FL	Paris	32
F8GC	Paris	61
	Paris	37
	Rennes	280
	Strasbourg	222.2
PTT	Toulousse	260
	Toulousse	389.6

GERMANY

	Aix-la-Chapelle	453
	Augsburg	560
	Berlin	566
AFT	Berlin	1635
	Berlin	418
	Bresslau	253
	Bremen	272.7
	Cologne	227
	Danzig	272.7
AFK	Doberitz	67.65
AFK	Doberitz	37.65
	Dortmund	283
	Dresden	275.2
	Elberfield	268.8
	Freiburg	577
	Frankfurt	390
	Gleiwitz	325
	Hanover	297
HA	Hamburg	372
	Kaiserlautern	270
	Kassel	252.1
	Kiel	254.2
	Konigsberg	276
	Langenberg	473
	Leipzig	259
	Munchen	535.7
	Munich	533
	Munster	234
AGJ	Nauen	56.7
AGC	Nauen	17.2
	Norddeich	1829
	Nurenberg	239
	Scharbeck	230
	Stettin	236.2
	Stuttgart	360
AFB	Zeesen	4000
AFP	Zeesen	2900
	Zeesen	1250

GREAT BRITAIN

2BD	Aberdeen	301
2BE	Belfast	242
5IT	Birmingham	326.1
6BM	Bournemouth	288.5
2LS	Bradford	252.1
5WA	Cardiff	310
2NM	Caterham	32.5
5SW	Chelmsford	24
5GB	Daventry	479
5XX	Daventry	1553
2DE	Dundee	288.5
2EH	Edinburgh	288.5
5SC	Glasgow	399
6KH	Hull	294.1
2LS	Leeds-Bradford	277.8
6LV	Liverpool	297
2LO	London	356

Call		Wave
2ZY	Manchester	377
5NO	Newcastle	261
5NG	Nottingham	275.2
5PY	Plymouth	288.5
6FL	Sheffield	272.7
6ST	Stoke-on-Trent	288.5
5SX	Swansea	288.5

HAITI

HHK	Port au Prince	361.2

HOLLAND

	Bloemendaal	566
PCJJ	Eindhoven	31.4
PCFF	De Bilt	1100
HDO	Hilversum	298
	Huizen	340.9
	Huizen	1875
PCLL	Kootwij	18.4
	Scheveningen	1950

HUNGARY

MTI	Budapest	545
MT2	Budapest	1050

ICELAND

	Akureyri	192
	Reykjavik	333.3

INDIA AND CEYLON

VUB	Bombay	357.1
2AX	Bombay	320
2FV	Bombay	387
VUC	Calcutta	370.4
VPB	Colombo	800
2GR	Madras	400
2HZ	Rangoon	350

IRISH FREE STATE

6CK	Cork	400
2RN	Dublin	413

ITALY

1MI	Milan	500.8
1NA	Naples	332
1RO	Rome	441.1
I1AX	Rome	45
1TO	Turin	274.1

JAPAN

JHBB	Hirasio	37.5
JOFK	Hiroshima	353
JODK	Keijo	357
JOGK	Kumamoto	380
JOCK	Nagoya	360
JOBK	Osaka	385
JFAB	Taipah	39.5
JOAK	Tokyo	375
JOIK	Sapporo	361
JOHK	Sandai	390

JAVA

JFC	Batavia	220
ANH	Malabar	17
	Surabaya	140
ANE	Vandoeng	31.86
ANE	Vandoeng	15.93
	Vandoeng	310

JUGOSLAVIA

	Belgrade	429
	Zagreb	307

KWANTUNG

JQAK	Dairen	395

LATVIA

KCX	Riga	526.3

LITHUANIA

	Kaunas	2000

MEXICO

XFF	Chihuahua	325
XES	Ciudad Lerdo	250
XEA	Guadalajara	250
XFC	Jalapa	475
XEY	Merida	548.6
XEX	Mexico City	325
XFX	Mexico City	357
XEN	Mexico City	410
XEB	Mexico City	450
XFG	Mexico City	470
XFI	Mexico City	507
XFA	Mexico City	600-500
XEH	Monterey	311
XEI	Morelia	300
XEF	Oaxaca	265
XEE	Puebla	312

NEW ZEALAND

1ZB	Auckland	275
1ZQ	Auckland	253
1YA	Auckland	333
3ZC	Christchurch	250
3YA	Christchurch	306
4ZB	Dunedin	295
4ZO	Dunedin	278
4ZL	Dunedin	246
4ZM	Dunedin	278
4YA	Dunedin	463
2ZM	Gisborne	275
2YB	New Plymouth	243
2ZQ	Masterton	220
2ZF	Palmerston	285
2ZA	Wanganui	505
2YA	Wellington	420

NORWAY

	Aalesund	511
	Bergen	366
LGN	Bergen	30
	Bergen	364
	Fredriksstad	394
	Notodden	283
	Oslo	493
	Porsgrund	453
	Rjuken	447.8
	Stavanger	277.6
	Tromso	500
	Trondhjem	243.9

PERU

OAX	Lima	360

PHILIPPINES

KZIB	Manila	260
KZKZ	Manila	270.1
KZRM	Manila	413

POLAND

	Cracow	314
	Kattowitz	408.7
	Posen	335
AXO	Warsaw	1411
	Wilna	435

PORTUGAL

Call		Wave
PIAA	Lisbon	305

ROUMANIA

	Bucharest	401.6

SALVADOR

AQM	Salvador	482

SPAIN

EAJ18	Almeria	320
EAJ13	Barcelona	462
EAJ1	Barcelona	349
EAJ13	Barcelona	277
EAJ9	Bilbao	434.8
EAJ3	Cadiz	400
EAJ16	Cartagena	330
EAR5	Las Palmas (Canary Islands)	250
EAR5	Las Palmas (Canary Islands)	350
EAM	Madrid	30.7
EAJ7	Madrid	424
EAJ2	Madrid	420
EAJ25	Malaga	250
EAJ19	Oviedo	280.4
EAJ22	Salamanca	405
EAJ8	San Sebastian	297
EAJ5	Seville	368

STRAITS SETTLEMENTS

1SE	Singapore	330

SWEDEN

SASE	Boden	1190
SMYB	Boras	230.8
SMUC	Eskilstuna	250
SMZK	Falum	315.8
SMXF	Gavle	204.1
SASB	Goteborg	322
SMSB	Halmstad	215.8
SMYE	Halsingborg	229
	Hamar	570
	Horby	257
SMSL	Hudiksvall	272.7
SMZD	Jonkoping	201.3
SMSW	Kalmer	254.2
	Karlsborg	52.2
SMSM	Karlskrona	196
SMXG	Karlstadt	220.6
SMTG	Kiruna	238.1
SMTJ	Kristinehamm	202.7
SMUW	Linkoping	500
SMXO	Malmberget	400
SASC	Malmo	260.9
SASG	Motala	1348
SMVV	Norrkoping	275.2
SMTI	Orebro	236.2
SMZA	Ornskoldsvik	187.5
SASF	Ostersund	720
SMTS	Saffie	252.1
SASA	Stockholm	436
SASD	Sundsvall	542
SMXQ	Trollhattan	277.8
SMZP	Udevalla	294.1
SMSN	Umea	229
SMRN	Uppsla	500
SMSO	Varborg	297

SWITZERLAND

HD3	Basle	1010
H9OC	Berne	32
HBA	Berne	403
HB1	Geneva	760
HB2	Lausanne	680
H9XD	Zurich	85
H9XD	Zurich	32
HBZ	Zurich	459

TURKEY

	Angora	1806
	Stamboul	1200

UNION OF SOVIET SOCIALIST REPUBLICS

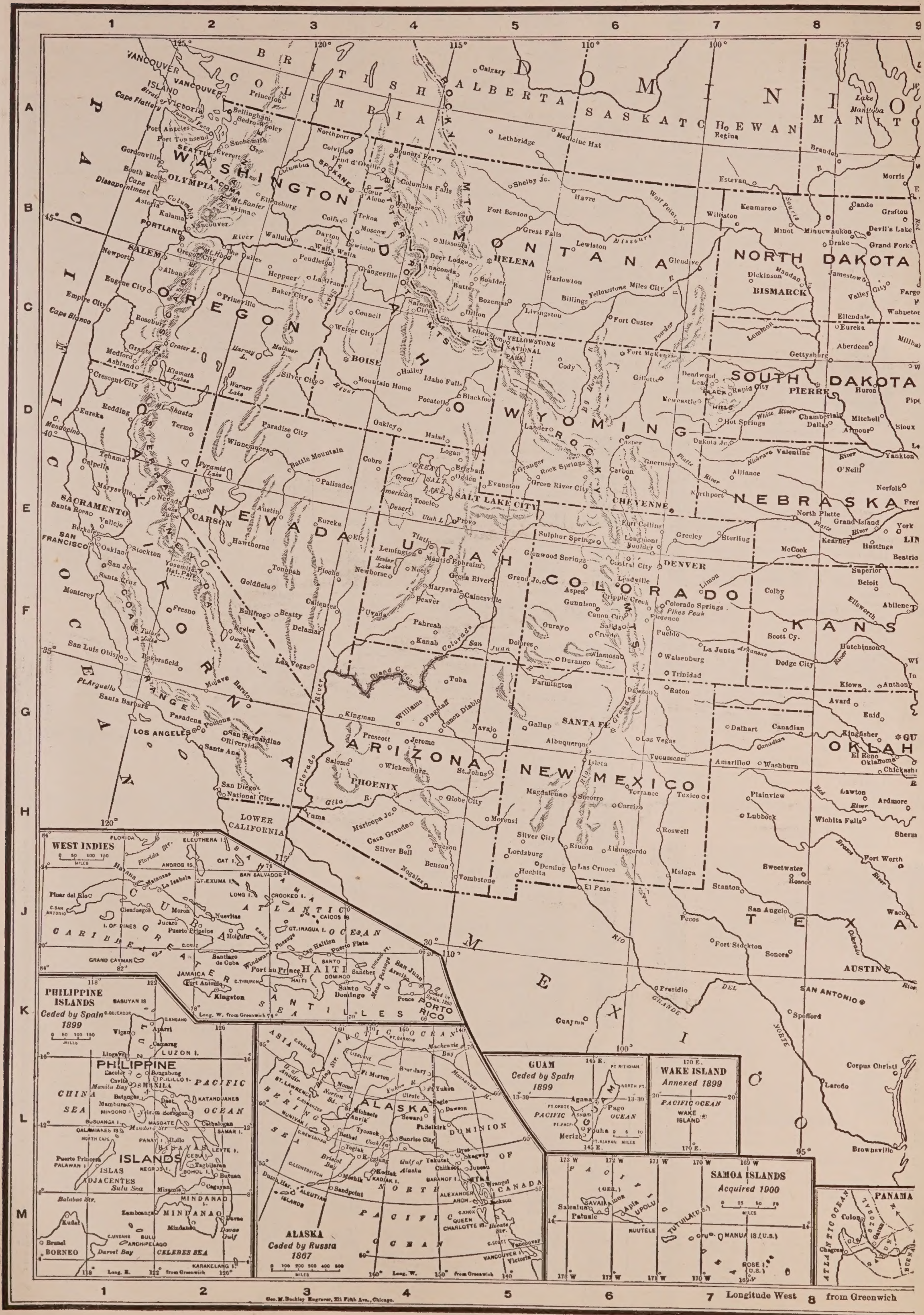
RA47	Armavir	720
RA56	Artemovsk	790
RA26	Astrakhan	700
RA45	Baku	750
RA8	Bogorodsk	750
RA30	Dneipropetrovsk	525
RA39	Gomel	925
RA7	Ivanovo-Vosnesensk	800
RA43	Kharkov	475
RA45	Kiev	775
RA34	Koursk	575
RA38	Krasnodar	513
RA59	Leningrad	150
RA18	Minsk	860
RA2	Moscow	450
RA4	Moscow	450
RDW	Moscow	1450
RA67	Nalchik	1075
RA13	Nizhni-Novgorod	840
RA40	Odessa	975
RA25	Orenburg	640
RA64	Petropavlovsk	350
RA46	Petrozavodsk	765
RA14	Rostov-on-Don	820
RA22	Samara	900
RA32	Saratov	420
RA9	Sevastopol	800
RA68	Smolensk	330
RA72	Smolensk	150
RA77	Stalino	730
RA20	Stavropol	550
RA15	Sverdlovsk	1050
RA27	Tashkent	715
RA11	Tiflis	870
RA21	Tomsk	300
RA44	Tver	690
RA51	Ulyanovsk	500
RA16	Vel Ustjuk	650
RA17	Vladivostok	480
RA41	Vologda	875
RA12	Vorenezh	950

URUGUAY

CWOA	Montevideo	428.4
CWOF	Montevideo	300
CWOG	Montevideo	280
CWOH	Montevideo	300
CWOK	Montevideo	260
CWOL	Montevideo	272
CWOH	Montevideo	265.5
CWON	Montevideo	256.5
CWOO	Montevideo	294
CWOR	Montevideo	350
CWOS	Montevideo	380
CWOI	Salta	272
CWOJ	Salta	250

VENEZUELA

AYRE	Caracas	375


BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
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MANITOBA
PACIFIC OCEAN
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IDAHO
MONTANA
WYOMING
UTAH
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Reno
Carson
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Palisades
Austin
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Hawthorne
Tonopah
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Bullfrog
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Grangeville
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Butte
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Bozeman
Livingston
Billings
Great Falls
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Lewistown
Glendive
Miles City
Fort Custer
Yellowstone National Park
Cody
Lander
Casper
Rock Springs
Green River City
Evanston
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Salt Lake City
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St. Johns
Grand Canon
Colorado River
Gila R.
Bismarck
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Devil's Lake
Minot
Williston
Dickinson
Mandan
Pierre
Deadwood
Lead
Rapid City
Black Hills
Hot Springs
Huron
Aberdeen
Mitchell
Yankton
North Platte
Grand Island
Kearney
Hastings
McCook
Valentine
O'Neill
Norfolk
Alliance
Northport
Colby
Ellsworth
Abilene
Hutchinson
Dodge City
Scott Cy.
Amarillo
Dalhart
Lubbock
Wichita Falls
Fort Worth
San Angelo
Austin
San Antonio
Laredo
Brownsville
Corpus Christi
Presidio
Pecos
Fort Stockton
Guaymas
RIO GRANDE DEL NORTE
WEST INDIES
ATLANTIC OCEAN
CARIBBEAN SEA
CUBA
GREATER ANTILLES
HAITI
PORTO RICO
Ceded by Spain 1899
Havana
Matanzas
Cienfuegos
Santiago de Cuba
Jamaica
Kingston
Port au Prince
Santo Domingo
San Juan
PHILIPPINE ISLANDS
Ceded by Spain 1899
LUZON I.
Manila
MINDANAO
Sulu Sea
CELEBES SEA
CHINA SEA
PACIFIC OCEAN
BORNEO
ALASKA
Ceded by Russia 1867
ARCTIC OCEAN
BERING SEA
NORTH PACIFIC OCEAN
DOMINION OF CANADA
Nome
Juneau
Sitka
Skagway
Yukon
Gulf of Alaska
ALEUTIAN ISLANDS
GUAM
Ceded by Spain 1899
Agana
WAKE ISLAND
Annexed 1899
SAMOA ISLANDS
Acquired 1900
SAVAII
UPOLU
TUTUILA (U.S.)
Apia
PANAMA
Colon
Longitude West from Greenwich
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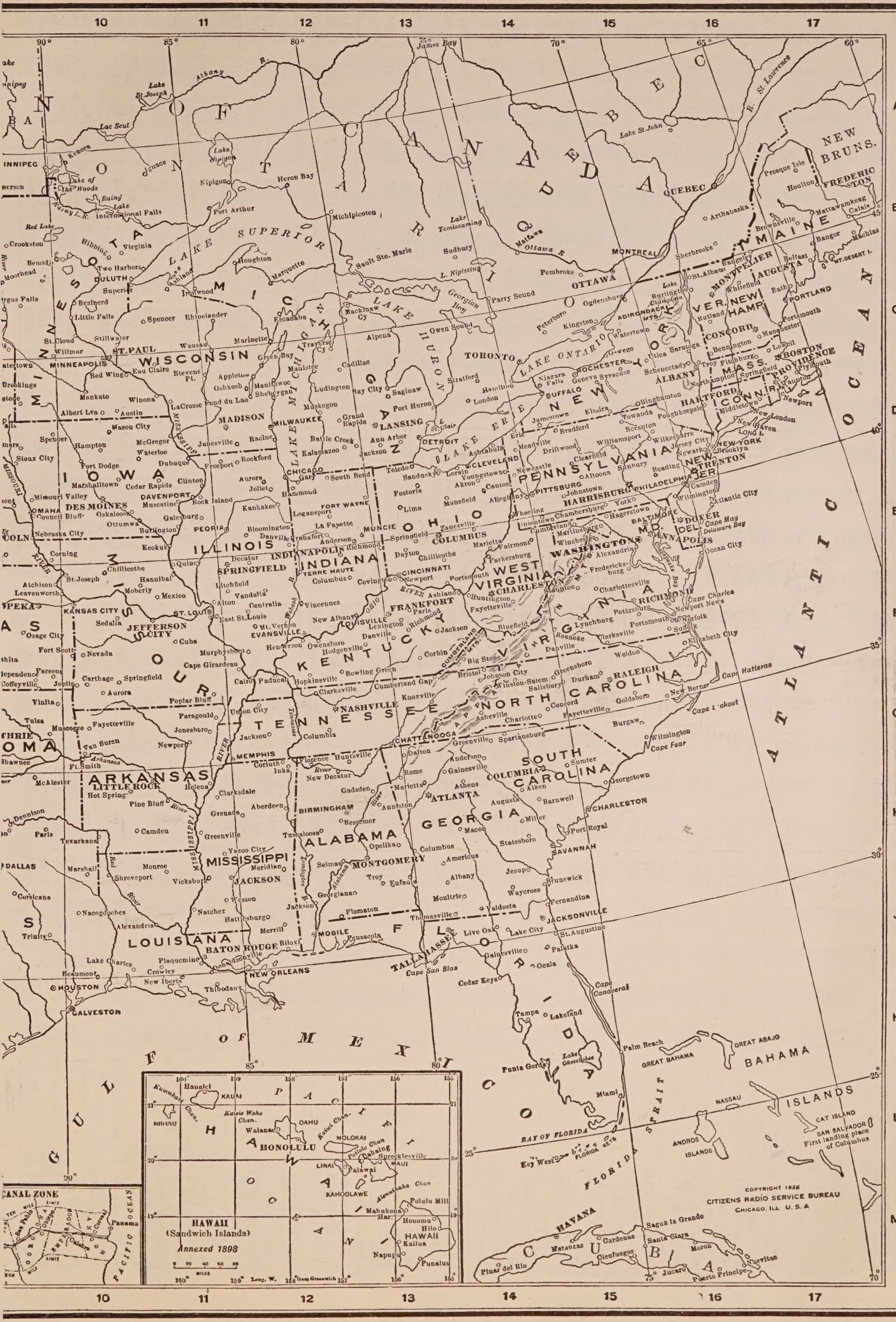
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NEW BRUNS.
FREDERICTON
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
Georgian Bay
James Bay
Lake Nipigon
Lake of the Woods
Lake St. John
St. Lawrence R.
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GULF OF MEXICO
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GREAT ABAJO
GREAT BAHAMA
NASSAU
ANDROS ISLANDS
CAT ISLAND
SAN SALVADOR First landing place of Columbus
FLORIDA STRAIT
BAY OF FLORIDA
FLORIDA KEYS
Key West
CUBA
HAVANA
Matanzas
Cardenas
Pinar del Rio
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Cape Lookout
Cape Fear
Cape Charles
Cape May
Cape Canaveral
Cape San Blas
Lake Okeechobee
Palm Beach
Miami
Tampa
Punta Gorda
Cedar Keys
CANAL ZONE
Panama
PACIFIC OCEAN
HAWAII (Sandwich Islands)
Annexed 1898
HAWAIIAN ISLANDS
PACIFIC OCEAN
KAUAI
NIIHAU
OAHU
HONOLULU
MOLOKAI
LANAI
MAUI
KAHOOLAWE
HAWAII
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Albuquerque, N. Mex.	....	1273	1670	774	1967	838	1577	1126	1248	1417	332	833	1360	228	968	561	803	588	773	1252	1492	717	663	1174	938
Atlanta, Ga.	1273	....	575	1830	933	960	695	583	368	550	1208	738	595	1293	1112	750	688	901	498	947	286	675	1935	317	335
Baltimore, Md.	1670	575	....	2055	358	1525	273	603	423	305	1505	913	398	1750	1143	1239	1245	1154	964	808	682	962	2313	498	792
Boise, Idaho	774	1830	2055	....	2266	1610	1872	1453	1663	1754	637	1155	1671	969	975	1263	1538	934	1384	1367	2098	1158	663	1623	1506
Boston, Mass.	1967	933	358	2266	....	1881	398	849	737	550	1766	1159	613	2067	1304	1574	1598	1415	1302	922	1015	1250	2590	823	1133
Brownsville, Tex.	838	960	1525	1610	1881	....	1575	1234	1184	1402	1047	1102	1398	682	1445	471	287	1013	650	1543	1025	923	1370	1093	777
Buffalo, N. Y.	1577	695	273	1872	398	1575	....	454	392	175	1368	762	218	1690	923	1221	1289	1019	956	560	880	862	2195	483	802
Chicago, Ill.	1126	583	603	1453	849	1234	454	....	249	307	918	310	236	1249	571	820	954	566	585	367	861	413	1741	268	481
Cincinnati, Ohio	1248	368	423	1663	737	1184	392	249	....	218	1090	509	234	1333	818	839	897	742	569	589	628	541	1892	92	410
Cleveland, Ohio	1417	550	305	1754	550	1402	175	307	218	....	1223	617	94	1521	838	1046	1116	871	787	518	768	700	2044	309	627
Denver, Colo.	332	1208	1505	637	1766	1047	1368	918	1090	1223	....	607	1153	554	642	643	925	353	749	970	1468	555	828	1035	878
Des Moines, Iowa	833	738	913	1155	1159	1102	762	310	509	617	607	....	545	980	397	640	851	256	488	458	1024	180	1433	477	485
Detroit, Mich.	1360	595	398	1671	613	1398	218	236	234	94	1153	545	....	1475	745	1018	1111	800	761	427	832	643	1976	315	621
El Paso, Tex.	228	1293	1750	969	2067	682	1690	1249	1333	1521	554	980	1475	....	1161	543	723	757	802	1422	1481	836	702	1253	978
Fargo, N. Dak.	968	1112	1143	975	1304	1445	923	571	818	838	642	397	745	1161	....	973	1218	440	875	393	1400	548	1426	818	882
Fort Worth, Tex.	561	750	1239	1263	1574	471	1221	820	839	1046	643	640	1018	543	973	....	283	544	273	1093	943	460	1212	751	448
Galveston, Tex.	803	688	1245	1538	1598	287	1289	954	897	1116	925	851	1111	723	1218	283	....	808	375	1277	799	677	1423	807	492
Hastings, Nebr.	588	901	1154	934	1415	1013	1019	566	742	871	353	256	800	757	440	544	808	....	513	666	1178	226	1177	693	591
Hot Springs, Ark.	773	498	964	1384	1302	650	956	585	569	787	749	488	761	802	875	273	375	513	....	901	728	326	1437	480	176
Houghton, Mich.	1252	947	808	1367	922	1543	560	367	589	518	970	458	427	1422	393	1093	1277	666	901	....	1216	633	1787	636	830
Jacksonville, Fla.	1492	286	682	2098	1015	1025	880	861	628	768	1468	1024	832	1481	1400	943	799	1178	728	1216	....	952	2153	595	591
Kansas City, Mo.	717	675	962	1158	1250	923	862	413	541	700	555	180	643	836	548	460	677	226	326	633	952	....	1352	480	370
Los Angeles, Calif.	663	1935	2313	663	2590	1370	2195	1741	1892	2044	828	1433	1976	702	1426	1212	1423	1177	1437	1787	2153	1352	....	1825	1602
Louisville, Ky.	1174	317	498	1623	823	1093	483	268	92	309	1035	477	315	1253	818	751	807	693	480	636	595	480	1825	....	319
Memphis, Tenn.	938	335	792	1506	1133	777	802	481	410	627	878	485	621	978	882	448	492	591	176	830	591	370	1602	319	....
Miami, Fla.	1710	610	958	2368	1258	1100	1184	1190	957	1088	1732	1338	1156	1662	1721	1150	941	1468	983	1545	328	1247	2355	923	878
Minneapolis, Minn.	980	905	948	1140	1125	1335	733	356	603	632	699	235	542	1156	219	870	1087	399	722	272	1192	413	1522	605	700
Missoula, Mont.	895	1790	1947	252	2124	1706	1740	1348	1578	1640	670	1074	1552	1115	819	1312	1595	891	1385	1208	2070	1117	910	1550	1483
Nashville, Tenn.	1117	218	597	1631	941	952	626	394	239	456	1018	523	468	1169	900	643	666	697	370	760	502	472	1777	153	195
New Orleans, La.	1030	427	1001	1713	1359	536	1087	831	708	922	1079	825	938	986	1221	470	288	870	358	1187	511	678	1675	623	358
New York, N. Y.	1810	747	170	2153	188	1695	291	711	568	404	1628	1023	483	1902	1213	1398	1415	1275	1125	849	838	1097	2446	650	953
Norfolk, Va.	1696	507	167	2137	467	1465	435	696	474	429	1562	983	522	1755	1258	1226	1195	1216	955	946	548	1009	2352	528	778
Oklahoma, Okla.	518	753	1173	1138	1490	659	1117	689	755	946	503	469	905	578	786	188	456	357	260	926	988	293	1182	675	422
Omaha, Nebr.	718	815	1026	1044	1280	1061	883	432	620	738	485	122	666	875	390	590	828	135	490	547	1098	165	1312	579	529
Philadelphia, Pa.	1748	663	90	2113	268	1614	278	664	501	343	1575	972	444	1834	1186	1324	1335	1222	1051	827	758	1037	2388	580	878
Phoenix, Ariz.	330	1592	2002	733	2295	1023	1904	1451	1578	1745	585	1154	1685	347	1225	858	1065	901	1094	1550	1800	1045	357	1512	1264
Pittsburgh, Pa.	1498	520	194	1863	478	1424	178	411	258	115	1320	718	208	1592	952	1097	1140	967	825	630	703	784	2135	345	660
Portland, Me.	2015	1022	446	2282	100	1961	438	892	802	603	1803	1197	657	2126	1313	1642	1678	1454	1371	924	1113	1300	2631	892	1205
Portland, Oreg.	1107	2172	2367	349	2553	1944	2167	1765	1987	2063	985	1479	1975	1286	1248	1612	1885	1271	1733	1638	2442	1397	825	1953	1852
Richmond, Va.	1628	470	128	2060	471	1428	375	618	399	353	1488	905	445	1695	1180	1170	1154	1142	897	870	953	937	2283	457	722
St. Louis, Mo.	938	467	731	1389	1036	975	662	259	308	490	793	270	452	1033	658	568	697	455	325	591	755	238	1585	242	242
Salt Lake City, Utah	483	1580	1858	292	2099	1317	1701	1260	1450	1567	372	952	1490	689	865	977	1249	708	1116	1242	1840	922	577	1400	1250
San Francisco, Calif.	893	2133	2451	516	2696	1675	2298	1855	2037	2163	946	1547	2087	993	1447	1454	1693	1297	1648	1833	2375	1500	345	1983	1800
Schenectady, N. Y.	1823	840	278	2120	150	1770	249	702	605	408	1618	1012	467	1930	1157	1445	1487	1267	1175	776	960	1107	2445	695	1010
Seattle, Wash.	1178	2180	2341	405	2508	2015	2130	1743	1974	2035	1020	1470	1945	1373	1206	1658	1938	1288	1759	1588	2450	1505	956	1945	1867
Shreveport, La.	764	548	1064	1433	1410	510	1080	725	688	904	799	624	891	752	1002	209	233	615	142	1043	733	326	1420	598	279
Spokane, Wash.	1028	1960	2110	290	2279	1852	1900	1514	1746	1804	827	1243	1715	1238	976	1470	1753	1061	1552	1360	2239	1286	939	1720	1652
Springfield, Mass.	1889	863	282	2196	79	1805	325	774	659	473	1692	1085	540	1990	1240	1495	1524	1340	1224	860	957	1173	2515	745	1055
Vermillion, S. Dak.	742	917	1083	973	1314	1161	916	479	694	785	468	187	705	920	284	689	938	167	605	510	1203	280	1291	663	642
Washington, D. C.	1648	542	33	2045	392	1493	290	594	403	303	1490	985	397	1726	1141	1210	1214	1139	936	813	647	943	2295	473	763

AIR-LINE DISTANCES IN STATUTE MILES

FROM/TO	Miami, Fla.	Minneapolis, Minn.	Missoula, Mont.	Nashville, Tenn.	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma, Okla.	Omaha, Nebr.	Philadelphia, Pa.	Phoenix, Ariz.	Pittsburgh, Pa.	Portland, Me.	Portland, Ore.	Richmond, Va.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Schenectady, N. Y.	Seattle, Wash.	Shreveport, La.	Spokane, Wash.	Springfield, Mass.	Vermillion, S. Dak.	Washington, D. C.
Albuquerque, N. Mex.	1710	980	895	1117	1030	1810	1696	518	718	1748	330	1498	2015	1107	1628	938	483	893	1823	1178	764	1028	1889	742	1648
Atlanta, Ga.	610	905	1790	218	427	747	507	753	815	663	1592	520	1022	2172	470	467	1580	2133	840	2180	548	1960	863	917	542
Baltimore, Md.	958	948	1947	597	1001	170	167	1173	1026	90	2202	194	446	2367	128	731	1858	2451	278	2341	1064	2110	282	1083	33
Boise, Idaho	2368	1140	252	1631	1713	2153	2137	1138	1044	2113	733	1863	2282	349	2060	1389	292	516	2120	405	1433	290	2196	973	2045
Boston, Mass.	1258	1125	2124	941	1359	188	467	1490	1280	268	2295	478	100	2553	471	1036	2099	2696	150	2508	1410	2279	79	1314	392
Brownsville, Tex.	1100	1335	1706	952	536	1695	1465	659	1061	1614	1023	1424	1961	1944	1428	975	1317	1675	1770	2015	510	1852	1805	1161	1493
Buffalo, N. Y.	1184	733	1740	626	1087	291	435	1117	883	278	1904	178	438	2167	375	662	1701	2298	249	2130	1080	1900	325	916	290
Chicago, Ill.	1190	356	1348	394	831	711	696	689	432	664	1451	411	892	1765	618	250	1260	1855	702	1743	725	1514	774	479	594
Cincinnati, Ohio	957	603	1578	239	708	568	474	755	620	501	1578	258	802	1987	399	308	1450	2037	605	1974	688	1746	659	694	403
Cleveland, Ohio	1088	632	1640	456	922	404	429	946	738	343	1745	115	603	2063	353	490	1567	2163	408	2035	904	1804	473	785	303
Denver, Colo.	1732	699	670	1018	1079	1628	1562	503	485	1575	585	1320	1803	985	1488	793	372	946	1618	1020	799	827	1692	468	1490
Des Moines, Iowa	1338	235	1074	523	825	1023	983	469	122	972	1154	718	1197	1479	905	270	952	1547	1012	1470	624	1243	1085	187	895
Detroit, Mich.	1156	542	1552	468	938	483	522	905	666	444	1685	208	657	1975	445	452	1490	2087	467	1945	891	1715	540	705	397
El Paso, Tex.	1662	1156	1115	1169	986	1902	1755	578	875	1834	347	1592	2126	1286	1695	1033	689	993	1930	1373	752	1238	1990	920	1726
Fargo, N. Dak.	1721	219	819	900	1221	1213	1258	786	390	1186	1225	952	1313	1248	1180	658	865	1447	1157	1206	1002	976	1240	284	1141
Fort Worth, Tex.	1150	870	1312	643	470	1398	1226	188	590	1324	858	1097	1642	1612	1170	568	977	1454	1445	1658	209	1470	1495	689	1210
Galveston, Tex.	941	1087	1595	666	288	1415	1195	456	828	1335	1065	1140	1678	1885	1154	697	1249	1693	1487	1938	233	1753	1524	938	1214
Hastings, Nebr.	1468	399	891	697	870	1275	1216	357	135	1222	901	967	1454	1271	1142	455	708	1297	1267	1288	615	1061	1340	167	1139
Hot Springs, Ark.	983	722	1385	370	358	1125	955	260	490	1051	1094	825	1371	1733	897	325	1116	1648	1175	1759	142	1552	1224	605	936
Houghton, Mich.	1545	272	1208	760	1187	849	946	926	547	827	1550	630	924	1638	870	591	1242	1833	776	1588	1043	1360	860	510	813
Jacksonville, Fla.	328	1192	2070	502	511	838	548	988	1098	758	1800	703	1113	2442	953	755	1840	2375	960	2450	733	2239	957	1203	647
Kansas City, Mo.	1247	413	1117	472	678	1097	1009	293	165	1037	1045	784	1300	1397	937	238	922	1500	1107	1505	326	1286	1173	280	943
Los Angeles, Calif.	2355	1522	910	1777	1675	2446	2352	1182	1312	2388	357	2135	2631	825	2283	1585	577	345	2445	956	1420	939	2515	1291	2295
Louisville, Ky.	923	605	1550	153	623	650	528	675	579	580	1512	345	892	1953	457	242	1400	1983	695	1945	598	1720	745	663	473
Memphis, Tenn.	878	700	1483	195	358	953	778	422	529	878	1264	660	1205	1852	722	242	1250	1800	1010	1867	279	1652	1055	642	763
Miami, Fla.	......	1516	2359	821	681	1095	802	1233	1402	1023	1998	1014	1357	2716	831	1067	2098	2603	1229	2740	950	2528	1210	1510	927
Minneapolis, Minn.	1516	......	1010	695	1050	1019	1047	692	291	985	1279	745	1145	1435	968	464	988	1585	975	1403	859	1173	1056	238	936
Missoula, Mont.	2359	1010	......	1582	1733	2030	2045	1162	978	1997	932	1754	2133	430	1967	1331	435	762	1978	395	1457	170	2060	887	1940
Nashville, Tenn.	821	695	1582	......	470	758	586	602	604	683	1445	472	1015	1970	526	253	1390	1958	820	1973	470	1752	863	704	567
New Orleans, La.	681	1050	1733	470	......	1173	932	575	845	1090	1318	923	1445	2063	899	599	1433	1923	1259	2098	280	1898	1287	960	968
New York, N. Y.	1095	1019	2030	758	1173	......	293	1324	1144	83	2142	313	277	2455	287	873	1972	2568	142	2419	1230	2190	120	1189	204
Norfolk, Va.	802	1047	2045	586	932	293	......	1186	1095	220	2027	316	565	2458	79	771	1925	2510	426	2440	1037	2211	411	1166	145
Oklahoma, Okla.	1233	692	1162	602	575	1324	1186	......	405	1256	843	1013	1550	1488	1122	456	862	1386	1354	1523	297	1324	1412	502	1150
Omaha, Nebr.	1402	291	978	604	845	1144	1095	405	......	1094	1032	837	1318	1373	1020	352	833	1425	1133	1372	617	1149	1205	115	1012
Philadelphia, Pa.	1023	985	1997	683	1090	83	220	1256	1094	......	2079	254	360	2419	205	808	1923	2518	205	2388	1153	2159	201	1143	122
Phoenix, Ariz.	1998	1279	932	1445	1318	2142	2027	843	1032	2079	......	1829	2345	1007	1960	1270	504	652	2152	1112	1067	1020	2220	1043	1980
Pittsburgh, Pa.	1014	745	1754	472	923	313	316	1013	837	254	1829	......	545	2174	242	561	1670	2264	350	2145	939	1918	400	891	188
Portland, Me.	1357	1145	2133	1015	1445	277	565	1550	1318	360	2345	545	......	2563	565	1094	2127	2725	197	2513	1484	2285	159	1345	480
Portland, Oreg.	2716	1435	430	1970	2063	2455	2458	1488	1373	2419	1007	2174	2563	......	2381	1723	636	536	2405	143	1783	295	2488	1293	2360
Richmond, Va.	831	968	1967	526	899	287	79	1122	1020	205	1960	242	565	2381	......	699	1850	2436	406	2362	985	2133	407	1089	96
St. Louis, Mo.	1067	464	1331	253	599	873	771	456	352	808	1270	561	1094	1723	699	......	1158	1738	898	1722	466	1500	958	450	710
Salt Lake City, Utah	2098	988	435	1390	1433	1972	1925	862	833	1923	504	1670	2127	636	1850	1158	......	592	1950	697	1155	548	2027	785	1845
San Francisco, Calif.	2603	1585	762	1958	1923	2568	2510	1386	1425	2518	652	2264	2725	536	2436	1738	582	......	2548	680	1655	730	2625	1383	2437
Schenectady, N. Y.	1229	975	1978	820	1259	142	426	1354	1133	205	2152	350	197	2405	406	989	1950	2548	......	2363	1290	2139	86	1165	313
Seattle, Wash.	2740	1403	395	1973	2098	2419	2440	1523	1372	2388	1112	2145	2513	143	2362	1722	697	680	2363	......	1820	229	2445	1282	2335
Shreveport, La.	950	859	1457	470	280	1230	1037	297	617	1153	1067	939	1484	1783	985	466	1155	1655	1290	1820	......	1621	1333	726	1035
Spokane, Wash.	2528	1173	170	1752	1898	2190	2211	1324	1149	2159	1020	1918	2285	295	2133	1500	548	730	2139	229	1621	......	2216	1055	2105
Springfield, Mass.	1210	1056	2060	863	1287	120	411	1412	1205	201	2220	400	159	2488	407	958	2027	2625	86	2445	1333	2216	......	1242	321
Vermillion, S. Dak.	1510	238	887	704	960	1189	1166	502	115	1143	1043	891	1345	1293	1089	450	785	1383	1165	1282	725	1055	1242	......	1073
Washington, D. C.	927	936	1940	567	968	204	145	1150	1012	122	1980	188	480	2360	96	710	1845	2437	313	2335	1035	2105	321	1073	......

—Compiled by Department of Commerce.

KC	Meters	STATIONS	DIALS	
			1	2
1500	199.9			
1490	201.2			
1480	202.6			
1470	204.0			
1460	205.4			
1450	206.8			
1440	208.2			
1430	209.7			
1420	211.1			
1410	212.6			
1400	214.2			
1390	215.7			
1380	217.3			
1370	218.8			
1360	220.4			
1350	222.1			
1340	223.7			
1330	225.4			
1320	227.1			
1310	228.9			
1300	230.6			
1290	232.4			
1280	234.2			
1270	236.1			
1260	238.0			
1250	239.9			
1240	241.8			
1230	243.8			
1220	245.8			
1210	247.8			
1200	249.9			
1190	252.0			
1180	254.1			
1170	256.3			
1160	258.5			
1150	260.7			
1140	263.0			
1130	265.3			
1120	267.7			
1110	270.1			
1100	272.6			
1090	275.1			
1080	277.6			
1070	280.2			
1060	282.8			
1050	285.5			
1040	288.3			
1030	291.1			

KC	Meters	STATIONS	DIALS	
			1	2
1020	293.9			
1010	296.9			
1000	299.8			
990	302.8			
980	305.9			
970	309.1			
960	312.3			
950	315.6			
940	319.0			
930	322.4			
920	325.9			
910	329.5			
900	333.1			
890	336.9			
880	340.7			
870	344.6			
860	348.6			
850	352.7			
840	356.9			
830	361.2			
820	365.6			
810	370.2			
800	374.8			
790	379.5			
780	384.4			
770	389.4			
760	394.5			
750	399.8			
740	405.2			
730	410.7			
720	416.4			
710	422.3			
700	428.3			
690	434.5			
680	440.9			
670	447.5			
660	454.3			
650	461.3			
640	468.5			
630	475.9			
620	483.6			
610	491.5			
600	499.7			
590	508.2			
580	516.9			
570	526.0			
560	535.4			
550	545.1			

WHOLESALE PRICES

For Dealers, Service Men, General Repairmen and Set Builders!

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CATALOG №19 for 1929
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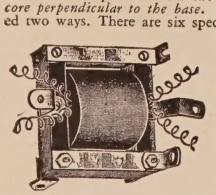
Can be mounted in either of three positions, that is, lying down, or standing up with the core parallel with the base on which it is resting, or standing up with core perpendicular to the base. Other replacement transformers can only be mounted two ways. There are six specially designed feet to provide this most convenient choice of mounting, and any of them can be removed at will, should you so desire. Thus, it is logical to conclude that our Replacement transformers can be installed in *ANY* receiver, either custom or factory built, no matter how small a space there may be available, whether such mounting is to be above, or beneath, a subpanel, or baseboard. The coils themselves are of the first quality, and are only found on the most costly Transformers. The core is the highest grade silicon steel, and of ample proportions. A happy combination of electrical values in both the core, and coil, assure maximum amplification possibilties—more than sufficient volume, yet with no trace of distortion! The silicon steel stampings are very rigidly bolted together by a generous size bar which is attractively nickel plated. 2½ in. long by 1½ in. high by 2¼ in. wide.



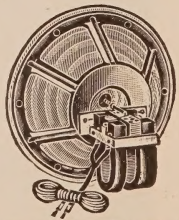
No. 7900. Your net Cost.................................. $0.80

TERMINAL STRIP MODEL

The primary and secondary leads are spaghetti covered, and unusually well soldered to generous size lugs. Strip is bakelite and properly lettered.
No. 7950. Your Net Cost.................................. $1.01

DUO-MAGNETIC CONE SPEAKER CHASSIS

No other magnetic speaker chassis is so strongly constructed! Note the heavily ribbed, sturdy "spider leg" white-lead casting! The entire frame work is one piece—a beautifully molded job! A Duo-Magnetic cone speaker unit is bolted to the rear mounting plate of the chassis, and the Burtex "ribbed" cloth cone is fastened between two heavy rings of cardboard—these rings are held in place by either screws and nuts, bolted to the frame of the chassis, or by being pressed up against a baffle mounting board. Although this speaker can be used as illustrated, it is strongly recommended that it be used in conjunction either with a baffle board or mounted within a box, a cabinet, or speaker compartment space in any console. *The tone quality is comparable to any speaker selling for many times its trivial cost. Will stand all the volume any radio set can "give it."* Will work satisfactorily with a D.C. or an A.C. set—with 90 volts applied through it, *or even as high as* 500 *volts! No blasting! No distortion! No rattling!* You will be most impressed with its *splendid performance!* Overall dimensions: Diameter 9 in. width of mounting ring ½ in., depth (rear of unit to mounting baffle board plate) 6¼ in.; diameter of unit mounting plate 4½ in.



No. 6850. COMPLETELY ASSEMBLED. Including DUO-MAGNETIC UNIT and cord. AS ILLUSTRATED. Your Special. Net Cost $6.75
No. 6852. MOUNTED IN A CABINET OF EXTRAVAGANT BEAUTY. Your Net Cost $9.44

RADIO SPECIALTY CO.

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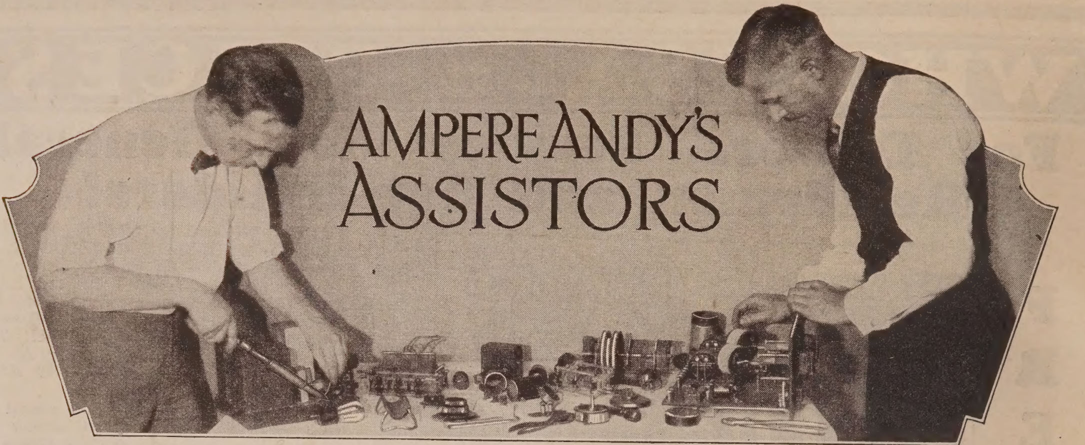
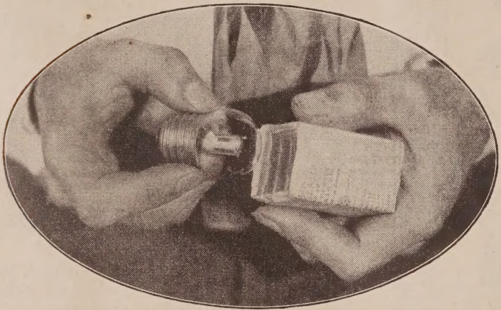
BUY FROM RADIO'S OLDEST MAIL ORDER HOUSE

AMPERE ANDY'S ASSISTORS

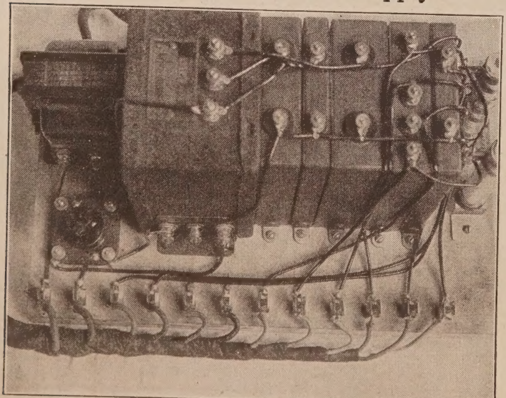


Neon Lamp Used as Pilot Light Indicating Radio Set Is Alive



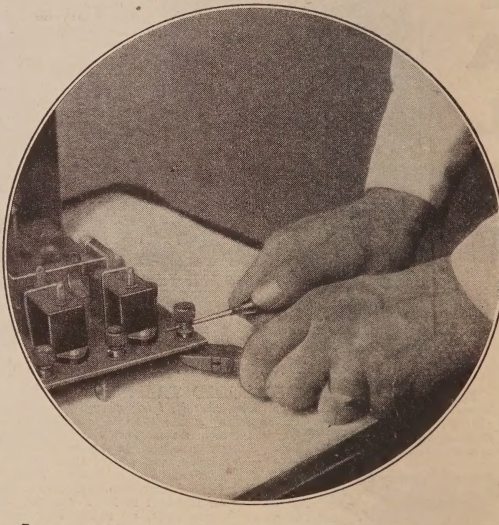
The forgetful set owner many times will go off and leave the receiver running, especially if the station tuned in has signed off. A simple telltale or indicator that will remind him of the fact that the electric circuit is still alive and, therefore, consuming current may be constructed quite easily with a 110 volt a. c. neon lamp, similar to the one shown in the photograph above. This lamp consumes a tenth of a watt and fits a standard light socket. It should be connected across the 110 volt a. c. line going into the power supply but located on the set side of the power switch. It is placed in a standard socket and may be mounted in any convenient place where it will be readily seen

Taping of Cable Facilitates Hooking and Unhooking the Power Supply



When the ordinary cable is used for connecting up a receiver and its power supply, the cable plug is located in the receiver end and the loose wires, coded according to color, are located in the power supply end. Occasionally the set owner will wish to disconnect the power supply and then on reconnecting it, he must remember the color code in order to get the connections in the proper position. One of the simplest ways of eliminating this bother is to tape up the end of the cable as shown in this illustration, bringing off the connections in sequence, starting at the left in the photograph and taping as each connection has been made. The wire at the extreme left will, therefore, be the shortest and the one at the extreme right will be the longest. With this system connections can be only made in the proper manner

Scratch Awl Comes In Handy for Tightening Binding Posts

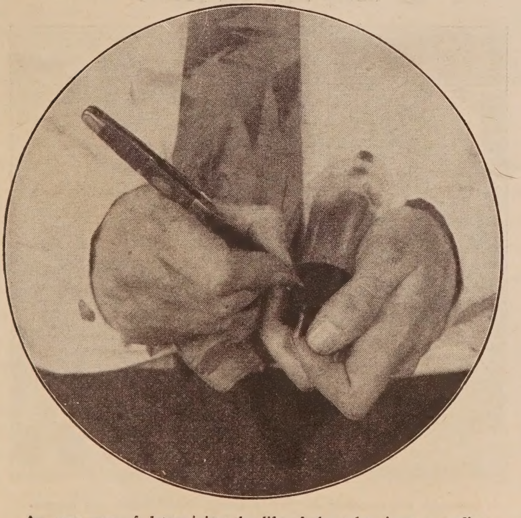


Loose binding posts are the bane of the average radio man's existence, especially where the servicing work is being done on a receiver and a number of loose contacts are found but are hard to trace. One of the simplest methods of making sure that a binding post is screwed up tight is to employ a scratch awl through the hole in the binding post, this being used as a lever to hold the post against the turning of the nut by means of a pair of pliers. Then again there is the condition that a repair man finds where the holes in binding posts are set at various angles, indicating that when the set was originally constructed no effort was made to see that the binding post holes were all lined up properly. Here again the scratch awl comes in very handily, because by means of this it is possible to face the hole at any desired angle and then tighten up the nut on the bottom of the binding post without the possibility of the post itself turning

Flat Radio Extension Cord Is Boon to Meticulous Housewives

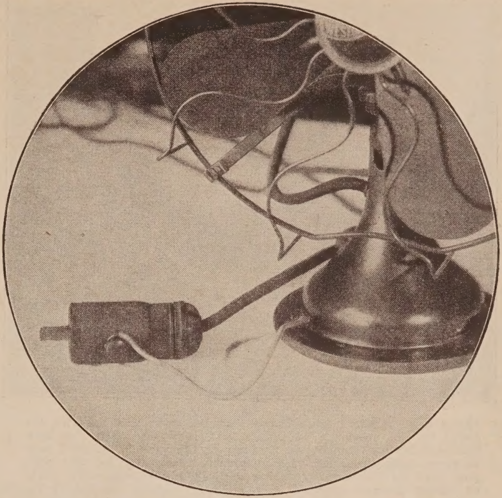
Ever since the radio was taken out of the attic and put into the living room, the housewife is the one that has to be consulted when it comes to any connections. Naturally there are many occasions when it is desired to rearrange the radio set or to alter its connections, when such a step would involve the running of a cord under a carpet or rug. Ordinarily this would not be desirable because of the ridge which the cord would cause and also the wear on that particular section of the carpet. An enterprising manufacturer has recently marketed a flat conductor in the form of an extension cord, which may be run under rugs or carpets without any bad effects. The cord comes in assorted lengths suitable for the various sized rugs. The plug for placing the connector in the baseboard receptable is located at one end and two standard receptacles are provided on the connector, the distance between the receptacles being approximately 9 or 12 feet, depending on the size of the rug. One of the receptacles may be used for a radio set and the other for a floor lamp, if desired

Tube Longevity Easily Ascertained by Writing Date on Base



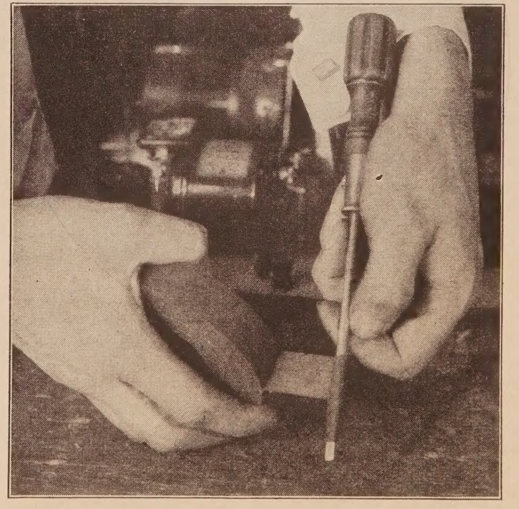
An easy way of determining the life of the tubes in your radio set is to make a practice of scratching the date of purchase on the base of the tube with a knife or other sharp pointed instrument, as illustrated in the accompanying photograph. This process not only enables the set owner to tell which of his tubes are lasting the longest, but also enables him to know whether the tubes in his spare box are new or old. This method of marking might also give the set owner some idea as to the respective merits of competing tubes

Fan Buzz in Radio Is Easily Removed by a Filter



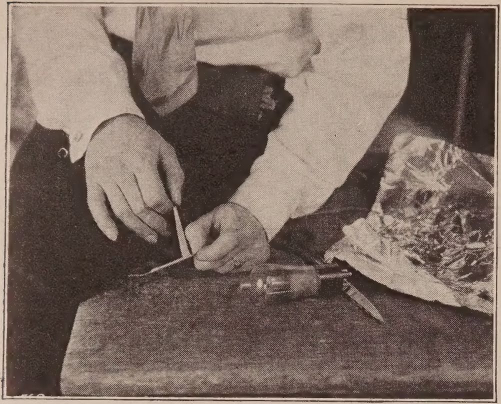
During the summer-time when the electric fan is called on to substitute for nature's breezes, and the radio set happens to be running at the same time, there is a possibility that a buzz may be heard in the speaker. This buzz, when using certain types of electric fans, will be produced by sparking at the brushes. This miniature spark is readily picked up by the receiver and amplified to an unpleasant degree in the speaker. Elimination of this buzz is not difficult if a filter is placed across the line, somewhat after the fashion shown in this photograph. In this picture the filter is plugged in on the fan cord, preferably as near the fan as possible, and an extension cord used from the baseboard receptable to the prongs of the filter. A second wire is then run from the binding post on the filter to the frame of the fan. This will only apply to the universal motors, where a commutator is used. In the alternating current motors there is no sparking and hence no buzz. In direct current motors a filter will be required

Insulate Screwdriver for Probing in A. C. Set When Operating



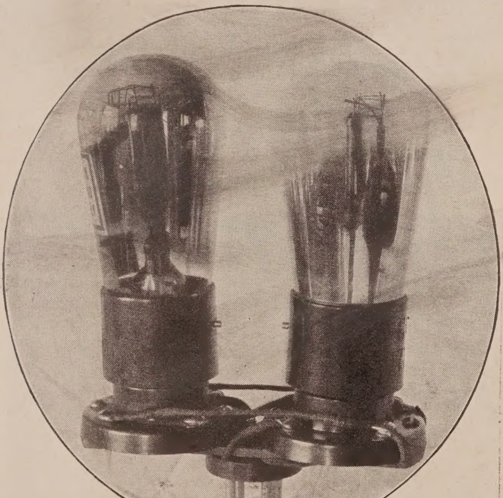
In many of the alternating current operated receivers a variable center-tapped resistance is placed across the filament winding to enable the user to find the electrical center of that circuit for the elimination of hum in the set. Adjustment of this center tap resistance must be made while the receiver is operating. This adjustment can easily be made with a screwdriver, provided the screwdriver is insulated so that it will not come in contact with any other portion of the set. This insulation can easily be provided by means of winding a few turns of tape along the metal portion of the screwdriver as illustrated in the above photograph

Home Builder May Make His Own Shielded Screen Grid Lead



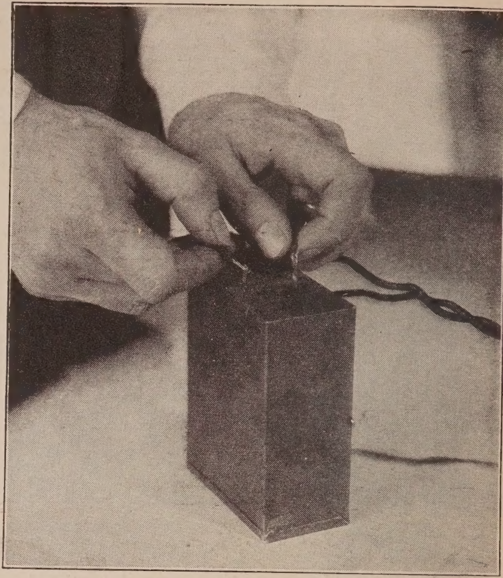
Many experimenters have found that better results may be secured in the operation of screen grid receivers when the lead between the inductance and the cap of the tube is shielded and in some cases grounded. An inexpensive makeshift for this purpose may be arranged by taking a piece of insulated wire, such as rubber covered stranded wire, cutting strips of tin foil ¼ in. wide and 4 in. or 5 in. long, and then winding these strips of tin foil smoothly around the rubber covering on the wire. After the length of rubber covering has been wound with the tin foil, a flexible wire may be bound on at the end of the tin foil, and this wire carried to the ground binding post, if desired

Simple Adapter Enables Use of Two Tubes in Parallel



In many of the older types of radio sets, where arrangements have not been made for the use of a 210 or larger power tube, improved results will be secured by the placing of two 112's or 171-A's in parallel. In most cases, the addition of a second socket is out of the question without rearranging the sub-base so that the adapter photographed above may serve nicely. It consists of an old tube base sawed off about ¼ in. from the bottom, so that it is solid across instead of being hollow. A small piece of bakelite wide enough to accommodate a socket and long enough to hold two sockets side by side is then fitted on top of the old tube base, and fastened thereto with a single bolt through the center. Before affixing the panel to the old base, the prongs on the tube base are heated so that the old connections are taken out. Then put in a length of wire in each prong and solder it, the length being sufficient to reach up around the bakelite strip and take in the two like terminals, such as the G and G, which are in parallel. When it is desired to operate two tubes in parallel, the two tubes are placed in the adapter and the unit then plugged into the last audio socket. Before making the adapter tight, the builder should be sure that the bakelite strip carrying the two tubes is pointed in the direction in which space is provided, because generally there is not much room between the second audio and the power tube

Some Types of Condensers May Be Repaired by Burning Out



As a rule the condensers used in most radio circuits employ tin foil for the plates and waxed paper for the dielectric. There are occasions when a condenser will become partly shorted through a breakdown, where the paper dielectric will have been burned away and allowing a portion of one of the tin foil sheets to touch the other tin foil plate. By testing with a meter such a condenser would show a short circuit. Repairs can at times be made on such a short by putting a high voltage across the condenser terminals and burning away the contact between the two pieces of tin foil. This method is not successful in every case, although there have been many occasions when such a remedy has been successful. Either the 110 volt line d. c. or a. c. may be used for this purpose, but a 25 watt lamp should be in series with one of the contacts in order to prevent a complete short circuit across the line. It is not advisable to do this with dry batteries, because shorting of dry batteries greatly decreases their life

Resistance Coupled Tube May Be of Help in First Audio

AUDIO
TRANSFORMER

Although not designed for this purpose, the UX-240 can be employed in the first audio stage with an increase in volume. When the 240 is used in the first audio in preference to the 201-A, it will be necessary to reduce the C bias on that particular stage to about one-half of the value normally required. While it is not guaranteed that the substitution of this tube will result in increased volume and the same quality as received before, nevertheless service men are authority for the statement that they have found few cases yet in which they could not get better volume with just the same quality by using a 240 in the first stage

Silver-Marshall 722 Is Band Selector Using Screen Grid Tubes

New Design Much More Selective and Sensitive Than Previous Model; Power Pack on Chassis

THE Silver-Marshall 722 receiver described in this article was designed with the object of providing a set with modern performance in every sense of the word at a price which would place it in the inexpensive set field. To secure the high performance which was wanted, a number of circuit refinements which are ordinarily associated with high priced receivers were included.

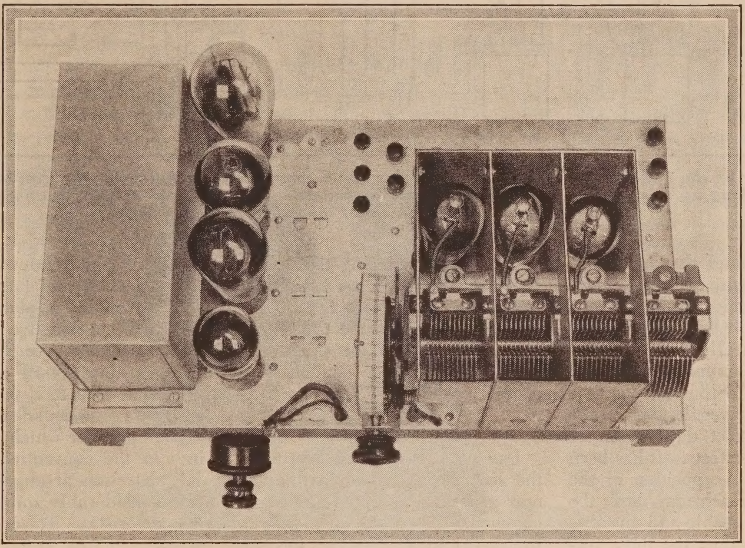


Fig. 1. This photograph represents the new S-M 722 Band Selector Seven. The power supply is at the left while the r. f. amplifier section is at the right

The result is a receiver with not only high gain but a very high degree of selectivity to make the additional gain "usable." This high degree of selectivity with good overall fidelity could only be secured by the use of one or more band selector or Siamese circuits. The advantage of the band selector circuit is readily apparent on tuning in distant stations, through locals, where the "skirts" of the local station normally cause interference. When operated at maximum sensitivity, this receiver has a band width at the bottom less than half that of a similar receiver with comparable gain using straight tuned circuits.

The advantages of having a tuned circuit ahead of the first radio frequency tube have always been recognized. Their application has been limited, however, because of the difficulty of ganging this first tuned circuit with the others in the following stages. By careful design it has been possible to reduce the misalignment due to the antenna to 3 per cent of the amount secured in preliminary experimental models using conventional r. f. transformers. This made it possible to place the band selector stage ahead of the first tube. This prevents the grid of the first tube being overloaded by local stations and producing harmonics in the output of this tube which might be amplified by the succeeding stages and produce objectionable interference, or "cross-talk," as it is frequently though somewhat improperly called.

Transformer Coupling

Transformer rather than impedance coupling was adopted because it is difficult to build a choke which will have a uniformly high impedance over the whole broadcast band and because of the difficulty of controlling the selectivity factor of the interstage coupling device. Whereas in d. c. screen grid tubes the plate impedance is sufficiently high so that the reflected resistance into the tuned circuit is very low, in the case of a. c. screen grid tubes with their lower plate impedance, particularly at high screen grid potentials where the gain is great and the selectivity is actually needed, the reflected resistance and hence the influence of the tube on the selectivity is very considerable. Impedance coupled amplifiers also offer considerable alignment trouble and are apt to have a poor gain ratio.

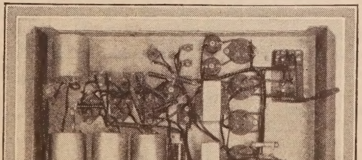


Fig. 2. This photograph shows the bottom view of the completed receiver. The r. f. coils are contained in the small cans shown at the left of the photograph

Due to the high gain of the receiver, it was found advisable to use r. f. chokes in both of the high voltage secondary leads to the rectifier tube to reduce carrier current disturbances from the power line. It was found that the conventional electrostatic shield between the primary and secondary was not sufficient to reduce the stray level from the line to the desired level.

A number of the constructional details may be of interest to the experimenter. These are shown in Figures 1 and 2. Although it was found possible to leave the leads to the control grid of the 224 tube from the tuning condenser unshielded and even the condenser itself unshielded (except for the die cast inter-section shields which are unusually

(This receiver tested and all illustrations made in our laboratory)

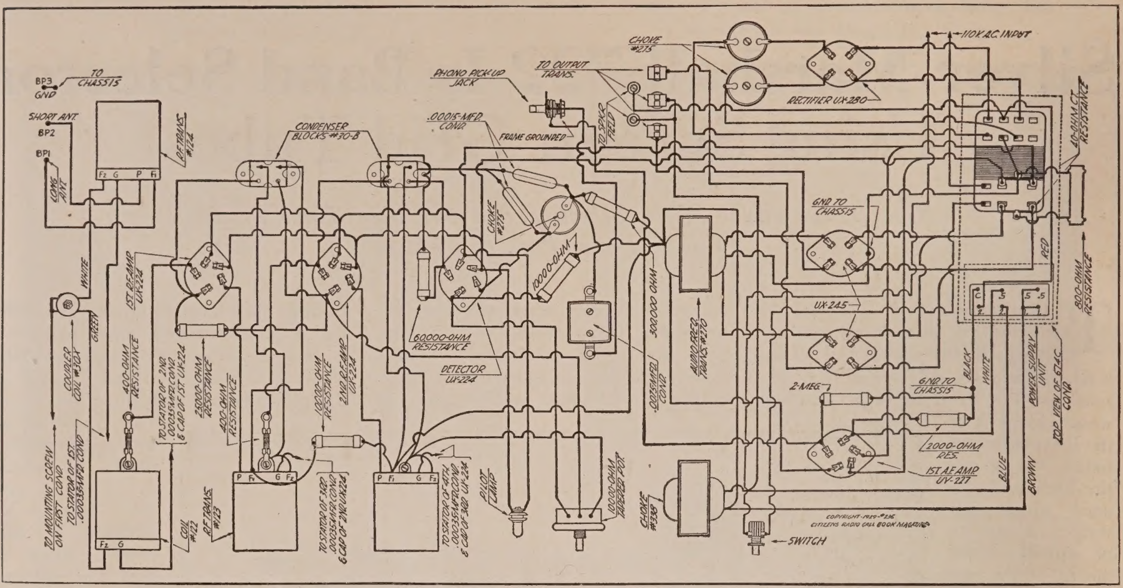

BP3
GND
TO CHASSIS
SHORT ANT.
BP2
BP1
LONG ANT.
R.F. TRANS. #124
CONDENSER BLOCKS #30-B
PHONO PICK-UP JACK
.00015-MFD. COND.
FRAME GROUNDED
TO OUTPUT TRANS.
CHOKE #275
RECTIFIER UX-280
110 V. A.C. INPUT
TO SPKR FIELD
40-OHM C.T. RESISTANCE
F2 G P F1
WHITE
GREEN
1ST. R.F. AMP. UX-224
CHOKE #275
10000-OHM
60,000-OHM RESISTANCE
DETECTOR UX-224
GND. TO CHASSIS
UX-245
300,000 OHM
.0075-MFD. COND.
AUDIO FREQ. TRANS. #270
RED
800-OHM RESISTANCE
COUPLER COIL #30X
400-OHM RESISTANCE
TO STATOR OF 2ND. .00035-MFD. COND. & CAP OF 1ST. UX-224
25000-OHM RESISTANCE
400-OHM RESISTANCE
10000-OHM RESISTANCE
2ND. R.F. AMP. UX-224
2-MEG.
GND. TO CHASSIS
BLACK
WHITE
POWER SUPPLY UNIT
TOP VIEW OF 674C COND.
C .5 .5 .5
2 2 1 1
2000-OHM RES.
1ST. A.F. AMP. UY-227
BLUE
BROWN
TO MOUNTING SCREW ON FIRST COND.
TO STATOR OF 1ST. .00035-MFD. COND.
F2 G
COIL #122
R.F. TRANS. #123
P F1 G F2
TO STATOR OF 3RD. .00035-MFD. COND. & CAP OF 2ND. UX-224
P F1 G F2
TO STATOR OF 4TH. .00035-MFD. COND. & CAP OF 3RD. UX-224
PILOT LAMP
10000-OHM TAPERED POT.
CHOKE #338
SWITCH
COPYRIGHT-1929-#236
CITIZENS RADIO CALL BOOK MAGAZINE

Fig. 3. ***Wiring of the S-M 722 Band Selector Seven may be accomplished by following the graphic diagram shown above. In hooking up this receiver it is essential that the connections be followed exactly as shown in the graphic, particularly the grid returns of the radio frequency stages***

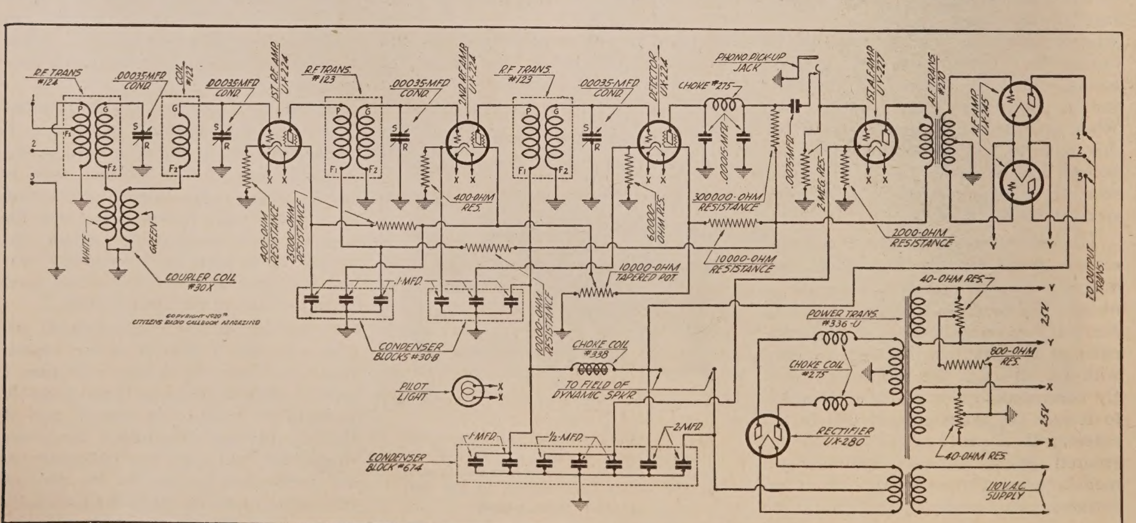
complete) it was found that advantage had to be taken of stray coupling effects to stabilize the receiver. While this may be done in one or two experimental models very successfully, it is undesirable where a large number are to be built. This is due to the fact that the stability of the receiver is then made dependent on an exact duplication of these stray coupling effects. It has been found that shifting the position of the leads as much as an inch may mean the difference between a stable and unstable receiver. To avoid this, the three section shield shown in Figure 1 was introduced. By placing the coil and associated circuits on the underside of the receiver as in Figure 2 and the tubes and condensers on the top side, advantage was taken of the shielding effects of the frame of the condenser and the chassis proper.

Screen Grid Detector

Use of plate circuit rectification in the receiver described in this article is now generally accepted and needs little comment. The use of a 224 tube in preference to a 227 seems advisable for the following reasons: higher detection coefficient, improved frequency characteristic and larger undistorted output for moderate plate voltage.

By using two audio stages with a transformer working into two 245 tubes, working out of a low impedance tube such as a 227, the frequency characteristic is not made a function of the plate impedance which varies over wide limits in the conventional single audio stage detection arrangement and results in a considerably improved frequency characteristic. The input impedance of the power tube is not only usually low, but

(*Continued on page* 138)


R.F. TRANS #124
.00035-MFD. COND.
COIL #122
.00035-MFD COND.
1ST. R.F. AMP. UX-224
R.F. TRANS. #123
.00035-MFD COND.
2ND. R.F. AMP. UX-224
R.F. TRANS. #123
.00035-MFD COND.
DETECTOR UX-224
PHONO PICK-UP JACK
CHOKE #275
1ST. A.F. AMP. UY-227
A.F. TRANS. #270
A.F. AMP. UX-245
1
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R
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WHITE
GREEN
COUPLER COIL #30X
400-OHM RESISTANCE
25000-OHM RESISTANCE
400-OHM RES.
60000-OHM RES.
.00015-MFD.
300000-OHM RESISTANCE
.0075-MFD.
2-MEG. RES.
2000-OHM RESISTANCE
Y Y
TO OUTPUT TRANS.
1-MFD.
10000-OHM TAPERED POT.
10000-OHM RESISTANCE
10000-OHM RESISTANCE
COPYRIGHT-1929
CITIZENS RADIO CALLBOOK MAGAZINE
CONDENSER BLOCKS #30-B
CHOKE COIL #338
TO FIELD OF DYNAMIC SPKR.
40-OHM RES.
POWER TRANS. #336-U
CHOKE COIL #275
800-OHM RES.
2.5V
2.5V
PILOT LIGHT
1-MFD.
1/2-MFD.
2-MFD.
CONDENSER BLOCK #674
RECTIFIER UX-280
40-OHM RES.
110 V. A.C. SUPPLY

Fig. 4. ***The schematic diagram of the receiver described in the accompanying article is shown above***

Radio Exerts Tremendous Influence in Development of Talkies

Many Radical Changes in Art of Recording and Reproducing Sound Since Year 1877

PART I

By J. E. SMITH*

THE young son of a college professor when shown a recent portrait of his father inquired, "Where is the sound?" This searching inquiry of youth more or less symbolizes the new era of the so-called talking movies. The achievement of synchronizing sound with motion pictures is of widespread application in motion-picture theaters, but in the background of the electrical recording and faithful reproduction of sound is the engineering progress which has made them possible.

Just as radio broadcasting has contributed to the appreciable improvement of the phonograph—largely through the once unfavorable comparison between the two methods of reproduction—so has radio furthered the objective of faithful reproduction in talking motion pictures. The original broadcasting stations did not maintain a high quality of modulation of the speech and music radiated; and, similarly, the earlier designs of radio receiving sets subordinated tonal quality to the expediencies of volume and sensitivity. This condition existed in the pioneer days of broadcasting.

When the invisible listening audience had tired of the thrill of hearing the call letters of distant transmitting stations—or, as the humorist expressed it, when persons in Chicago no longer stayed awake pending the retirement of citizens of San Francisco—there arose a demand for fatihful reproduction in broadcast reception. The radio terms sensitivity and volume were to be displaced, or at least relegated to the background by such phrases of "good tonal quality" and "faithful reproduction." These signified a desire for fidelity of translation—that is, the waves emitted from the transmitting station should be well modulated and they should be received at the receiving station with a fidelity of tone.

Quality Wanted

This public demand not only resulted in a substantial improvement of the broadcast transmitters—the quality of modulation as well as an extension of the octaves of music transmitted—but it produced a marked improvement in the manufacture of receiving sets. Particularly, the audio-frequency amplifiers were subjected to a proving process—with fidelity to the quality of sound and distortionless amplification as the requirements. This exercised fundamental changes in the commercial methods of recording and reproducing sound. And in this development lies the influence exerted by radio in furthering the perfection of talking motion pictures. However, it must not be inferred that the improvement of radio transmission and reception has paralleled the recording and reproducing of sound—or that the former mirrors the development of the theory and fundamentals of the art of electrical recording of sound. For the latter antedates radio broadcasting by a great many years.

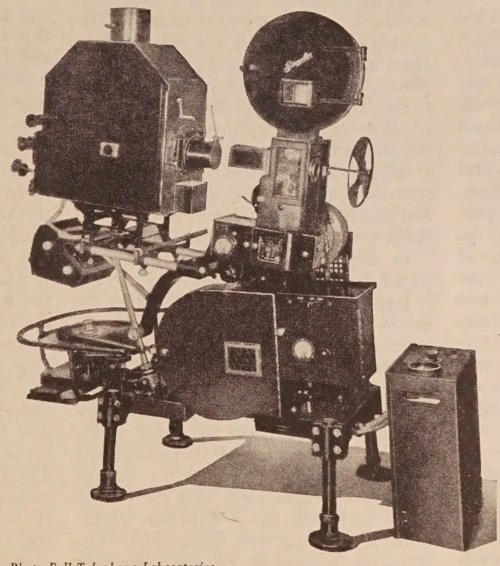

Photo Bell Telephone Laboratories

Fig. 1. This photograph represents one of the Western Electric projectors for sound pictures

Moreover, the instruments now in vogue for electrical recording and reproducing speech are the products of painstaking research over a long period of years. This electrical and mechanical equipment is the result of an indefinite study of such factors as speech and hearing, the conversion of energy between acoustic and electrical systems, and electrical instruments for recording, amplifying, and reproducing sound. This process of evolution in the development of electrical and reproducing equipment is comparable to the ocean battering against a wall, apparently making no inroads, when abruptly the whole structure topples. Primitive man may have known that objects are set into vibration by intense sounds and the ancient Greeks learned that sound is perceived by the ear as a result of a disturbance in the air. However, it remained for a Frenchman — Leon Scott — to construct the first instrument for recording sound. That was in 1857, and the instrument was termed the "phonautograph."

Phonograph's Daddy

By means of the phonautograph it was possible to translate sound waves into a graphical record but at that time no one was able to devise a means for translating this graphical record back into sound waves again. The phonautograph consisted essentially of a mouthpiece which received the sounds to be recorded. At the closed end of this mouthpiece there was a diaphragm which was attached by a system of levers to a stylus, the latter being given a lateral motion by the diaphragm. The stylus was so mounted that it rested against a piece of smoked paper which, in turn, was attached to a cylinder and the latter was rotated. When the phonautograph was in operation it functioned in the same manner that the Edison cylindrical wax records revolve; that is, it moved laterally during rotation. So it was in this manner that the first graphical records of sound were made.

---

*President, National Radio Institute, Washington, D. C.

Twenty years later, in 1877, Thomas Edison gave the world his epoch-making invention, the "phonograph," by means of which it was possible to record and reproduce sounds. Edison's device was quite similar to Scott's, but Edison used tinfoil instead of smoked paper, and he also attached the stylus directly to the diaphragm instead of through a system of levers as Scott did. Thus in Edison's device an impression of variable depth was traced in the tinfoil which has since come to be called the "hill and dale" system of wax recording.

In recording sounds Edison then used a horn-shaped mouth-piece which picked up the vibration to be recorded. At the small end of this horn there was a diaphragm, with a stylus attached, which traced a track of variable depth in a piece of tinfoil placed on a cylinder which was made to rotate and travel in a lateral direction at the same time. Edison used the same device for reproducing sounds by simply placing the stylus back at the start of the finished record and allowing it to follow the track in the tinfoil as the cylinder was rotated at the same speed it had been revolved at during recording. The up-and-down movement of the stylus was imparted to the diaphragm, which set up disturbances in the air that caused sound waves to emanate from the mouth of the horn.

Recording and reproducing equipment was decidedly crude at the time Edison first brought out the phonograph and although inventors of that era bent their energies towards developing electrical recording and reproducing equipment, their minds outdistanced their facilities. An amplifier of electrical energy, like the vacuum tube, was unknown at that time and even as late as the early part of the present century acoustical devices, like radio transmitters, receivers, sound recorders, and reproducers of wax records, were not highly developed.

Many Radical Changes

Many radical changes have taken place in the art of recording and reproducing sound, since 1877. We have had both the cylindrical and the disc form of the wax record. Mechanical recording has given way to electrical recording. Mechanical reproduction has given way to electrical systems of reproduction and during the last few years photographic recording has entered the commercial field as a worthy competitor of the present-day methods of electrically recording on wax disc, and today both wax and photographic records are used in conjunction with talking movies.

We should not lose sight of the fact, however, that radio educated the people to insist upon quality reproduction and their demands for fidelity in tone materially hastened the development of the high-grade audio-amplifying equipment which has made talking movies a successful realization. This type of entertainment is in its infancy at the present time and the results are far from what may reasonably be expected a year from now.

There are two general methods of recording sound in connection with the making of talking pictures at the present time, namely, the one in which the sound is recorded on a wax disc and the other in which the sound is recorded on standard motion-picture film. The sounds to be recorded are changed into electrical energy by means of the microphone, common to broadcasting stations. This sound, in the form of electrical energy, is amplified through various stages of vacuum-tube amplifiers, to a sufficiently high level to actuate the recording mechanism—just as speech and music are greatly amplified at the radio transmitting stations.

In the case of disc recording, the sound, in the form of electrical energy, is translated into mechanical energy by means of a recording stylus. This is attached to an armature which, in turn, is actuated by a magnetic field, which is modulated by the sound currents. The electrical energy applied to the recording stylus follows the same variations in amplitude and frequency that the sound waves striking the microphone diaphragm have, and these electrical variations cause duplicate variations in the magnetic field. This controls the movement of the recording stylus, and the latter is given a lateral motion which also coincides in frequency and amplitude, if that is desirable. However, in actual operation it has been found desirable to have the frequency response curve of the cutting stylus drop off on the low end.

The sound in the form of mechanical energy is changed into a record engraved in a wax disc by means of the cutting stylus. This is permitted to cut into a wax disc while the latter is rotated beneath the cutter and the latter is simultaneously moved laterally so that a spiral groove will be cut in the wax disc. The lateral motion given to the cutter, as the wax disc rotates, is imparted by means of a lead screw, which is geared to the driving mechanism. In disc recording, to summarize the process, the sound to be recorded is transformed into electrical energy, then amplified and tansformed into mechanical energy, and finally translated into a record engraved on a wax disc in the form of a spiral track.

In the case of recording sound on a film, the transitions are the same as the foregoing with the exception of the last two steps. In film recording the amplified sound, in the form of electrical energy, is changed into light by some method—this being a function of the recording system employed. For instance, in the Fox-Case system, electrical variations are changed into light variations by means of a flashing lamp, termed an aeo-light, the brilliancy of which can be modulated by electrical energy. In the case of motion-picture concerns using the Western Electric Company's light valve system of recording, a constant source of light is employed. The light valve, however, is actuated by electrical energy and the amount of light that it allows to pass, and the frequency of the variations in this light, are a function of the valve and frequency of the electrical currents passing through the light-valve "ribbons."

In the case of film recording, then, we have the amplified electrical energy transformed into light variations and these variations in light are passed on to the negative film. The latter passes the light-gate aperture at the rate of 99 feet per minute, and when this negative is developed there is a sound record on the film in the form of density variations.

A summary of the transitions occurring in film recording shows that the sound to be recorded is transfomed into electrical energy, amplified, transformed into light variations, and finally transformed into a sound track on the film. The latter is in the form of a track of constant width but of varying density. In one general system of film recording, known as the variable density method, it is in the form of a track of constant width but of variable density. In the second general method of recording sound on film, it is known as the variable area method.

Commercial Systems

The idea may be fairly deep-rooted that the only commercial method of recording talking movies is the Vitaphone system; and, then again, there may be citizens in more up-to-date communities who know that there are two systems of recording sound pictures, namely, the Vitaphone and the Movietone. Those who have been suffering with the illusion that these two outstanding sound-recording systems are the only ones will find the following facts somewhat surprising.

On January 1, 1929, the following systems of recording talking pictures were in existence:

1. *VITAPHONE*

The Vitaphone system of recording is one of two systems developed by the Bell Telephone Laboratories, Inc., for the Western Electric Company. (Their other system is called Movietone.) The Vitaphone is a phonographic system in that the sound is recorded on discs. Warner Brothers obtained the right from the Western Electric Company to use the Vitaphone system of recording and demonstrated it to the public in their theaters in 1926.

2. *MOVIETONE.*

About the time that Warner Brothers demonstrated the Vitaphone to the public, William Fox, president of the Fox Film Corporation, realizing the unexpected trend in the amusement field and sensing the tremendous box-office potentialities of sound pictures, formed an alliance with Theodore W. Case. This scientist had invented a "flashing lamp" that could be used as a basis of a photographic system of recording. The Fox-Case Movietone Corporation was formed to develop this system of recording, and Fox Movietone was demonstrated to the public in 1927. A little later the Western Electric Company introduced their photographic system, which they called Western Electric Movietone. In the Western Electric system, a constant source of light shines through a light gate, which is controlled by the sounds to be recorded. Then they strike the sensitive surface of the film on which the sounds are to be recorded. The opening and closing of the light gate causes the light reaching the film to be modulated. Thus we have a light reaching the film which is variable, and which varies in accordance with the sounds to be recorded. In the Fox-Case Movietone system, the same result is obtained but in this method a source of light is used which can be modulated at an audio-frequency rate. Thus actually we have a source of light which varies in accordance with the valve and frequency of the sounds to be recorded and no light gate is required between the source of light and the film. William Fox is the only one using the Fox-Case Movietone system, whereas most of the larger motion-picture concerns use the Western Electric method. Therefore, when you see a Movietone picture, (with the exception of the Fox Movietone), you will know that it was recorded by the Western Electric system. When you see and hear a Fox Movietone production you will know that it was either recorded by the Fox-Case Movietone or the Western Electric Movietone system, because Fox is using both Movietone systems of recording, having obtained the right from the Western Electric Company to use their system. However, it is safe to assume that all Fox Movietone News Reels that you see and hear have been recorded by the Fox-Case method. This method has been used on all Fox Movietone News "shots" to date, primarily in view of the fact that the Fox-Case system is quite portable—at least much more so than the Western Electric system, and is, therefore, particularly adaptable to news reel work. At the present time, the Western Electric Movietone system is mainly one for studio work, so there we have the two Movietone systems, the Fox-Case system for use wherever portability and ruggedness are required and the Western Electric system for use where portability can be sacrificed for quality and ruggedness. That is, the latter factors can give away to the delicacy required for high-grade studio production work.

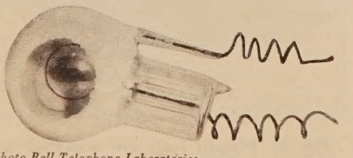

Photo Bell Telephone Laboratories

Fig. 3. A photoelectric cell similar to the one photographed above is used in the production of music and sound films

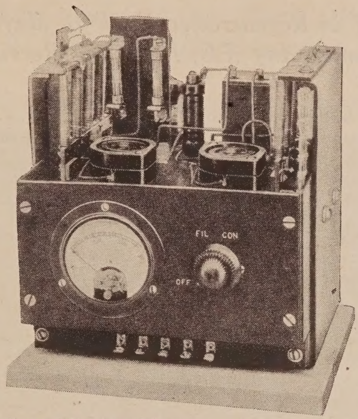

Photo Bell Telephone Laboratories

Fig. 2. Audio amplification is accomplished by means of the amplifier shown above into which is placed the photoelectric cell shown in Fig. 3

3. *PHOTOPHONE*

Photophone, formerly "Palophotophone," was developed for the Radio Corporation of America by Dr. C. A. Hoxie of the General Electric Company's research staff. This is a photographic system in that the sound is recorded on standard motion picture film, but the nature of the sound track produced by this recording system differs from that produced by the two photographic methods mentioned above, in one important respect. In both the Fox-Case and Western Electric Movietone systems, the sound is recorded on the film in the form of a track of constant width but of varying density, whereas sound recorded by the Photophone system is in the form of a track of constant density but of varying width.

The sound pick-up system of the Radio Corporation of America's Photophone consists of two essential elements —an optical system and a photo-electric cell. The optical feature involves the use of a small lamp, which flings a beam of light into an optical barrel. The latter, in the order named, contains a condenser lens, a slit, and an objective lens. The lamp is fitted into a special base and the only adjustment required is to move it vertically up and down in the socket so as to afford the greatest amount of light. While this adjustment is in progress, the light falls on a white card positioned before the photo-electric cell—thus checking the illumination. Three of these lamps occupy a revolving base in the sound-reproducer head, thus meeting an emergency if one of the lamps burned out during a performance.

The so-called area sound track is employed in the Photophone system of electrical recording. It is essential that the light—a beam about one inch in diameter and illuminating a slit .510 of an inch wide and .006 of an inch high—cover the entire width of the .070-inch sound track and overlap .0075 inch on each side. If the sound track is only partially lighted, its maximum and near-maximum peaks will be severed and the result is a corresponding depreciation in the value of the sound picture. This beam of light, moreover, must strike the motion-picture film exactly perpendicular to its edges, as the light travels through the projector. If, for instance, the light falls at an angle it will cut some of the recorded lines and result in distorted reproduction. Instruments have been devised for making an adjustment of the slit of light.

The Photophone sound pick-up gives the light beam passage to the photo-electric cell after it has gone through the sound track. The black and transparent areas of the sound track in pass-

(*Continued on page* 112)

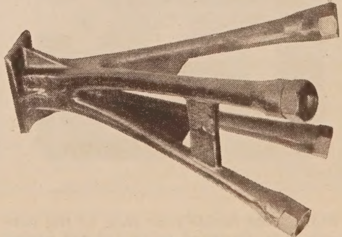

Photo Bell Telephone Laboratories

Fig. 4. The throat illustrated above is the one used whenever it is desired to employ a number of horns for outdoor use

Aero Short Wave A.C. Converter for Distant Broadcast Programs

Unit Using 227 in Regenerative Hook-up May Be Attached to Almost Any A.C. Energized Receiver

WITH hundreds of thousands of alternating current factory-built receivers in the hands of the listening public, there has been a widespread demand for a short wave adapter by means of which the listener might be relieved of the necessity of listening only on the broadcast band. In answer to this demand Aero Products, Inc., have recently designed two types of shielded and filtered short wave converters, the model A which is described in this article being for alternating current sets and the model D for battery operated sets. In the case of the model A here described, the converter may be used with any of the factory or custom built sets in which the 227 is employed as a detector. In order to take care of the latest designs of receiving sets where the 224 is used as a power detector, still another model is being designed by Aero.

As will be seen in the schematic circuit shown in Fig. 2, the unit consists essentially of inductances with three windings. The primary winding is aperiodic and remains in the unit at all times. The plug-in coil has a regenerative winding wound at one end of the secondary. Regeneration control is by means of the 8000 ohm variable resistance shown in the schematic diagram. This control is the knob at the left in the photograph, Fig. 1. An r. f. choke is used to prevent the passage of radio frequency into the amplifier. A 227 tube is utilized, its grid circuit being biased by means of a 10 megohm leak. A .00015 mfd grid condenser is used. The range of the variable condenser employed in the set is .00014 mfd and is of sufficient capacity to cover each coil. Three coils are provided with the converter and permit tuning over the following ranges: 15.6 to 32 meters, 26.2 to 48.7 meters and 46.7 to 90 meters.

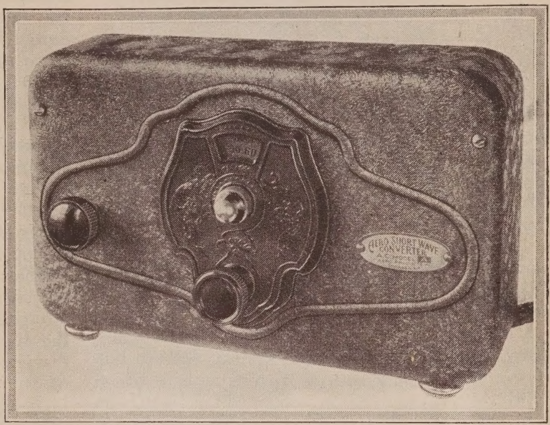

Fig. 1. Compact and efficient is the Aero short wave converter illustrated above

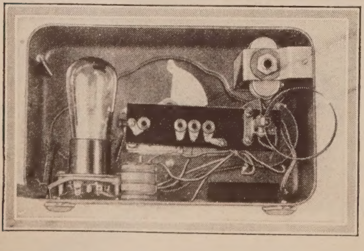

Fig. 3. An inside rear view of the converter is disclosed in the above photograph

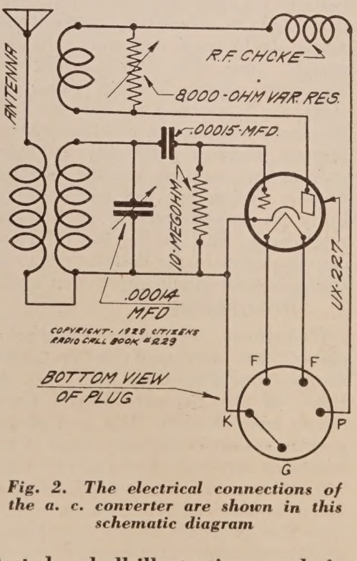

Fig. 2. The electrical connections of the a. c. converter are shown in this schematic diagram

Plugs Into Set

The converter is so arranged that it may be plugged into the detector socket of any tuned r. f. receiver where a 227 is used. When employed on a superheterodyne it must be plugged into the second detector socket. Four wires from the circuit shown in Fig. 2 are cabled and lead into a five-prong plug, a bottom view of which is also illustrated in the schematic.

In Fig. 3 is shown the inside rear of the converter unit, while Fig. 4 shows the back view of the converter with coil plugged into place.

Briefly, the steps necessary for putting into operation the converter are: First, remove the detector tube from the broadcast receiver, next remove three screws and the filter control knob from the rear of the converter unit sliding the back plate back; next place the 227 detector tube from the set in the socket of the converter. The three screws and the filter control knob should then be replaced. Next plug in the coil on the

(*Continued on page* 126)

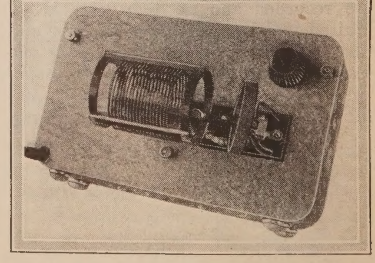

Fig. 4. Plug-in coils are mounted on the back of the filter as shown in this picture

(This converter tested and all illustrations made in our laboratory)

Scott Gives An Impetus to Custom Building With His New Set

Merchandising Policy Altered So New World's Record Model May Be Sold to the Discriminating

REALIZING the importance of the custom built market and that the demand for custom built radio receivers will exist for a good many years regardless of the trend of factory built receivers, the Scott Transformer Co., designers of the World's Record a. c. 10 described in this article, are now directing all of their activities towards supplying the custom built market through sales representatives working direct with the factory.

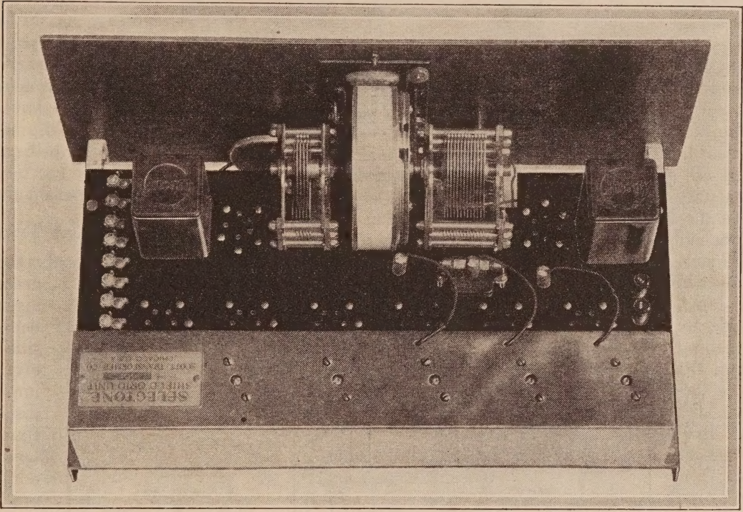

Fig. 1. In this photograph is shown the rear view of the new World's Record a. c. 10. Those who have been accustomed to the Scott merchandise will notice quite a departure between the latest model and the previous one

In order to enable the representatives to outperform the factory built receivers on distance and quality, much energy has been spent in research, and the World's Record a. c. 10 is a culmination of all of the Scott designs. The distance getting propensities of these receivers are well known to our readers. The latest model is a single control superheterodyne with four stages of carefully balanced r. f. amplification. There is one tuning dial for selecting stations. A small antenna balancer knob is provided for adapting this receiver to different types of antenna used. The second control is the volume control. An "on-off" switch is provided on the front panel below the main tuning knob for turning the set on or off.

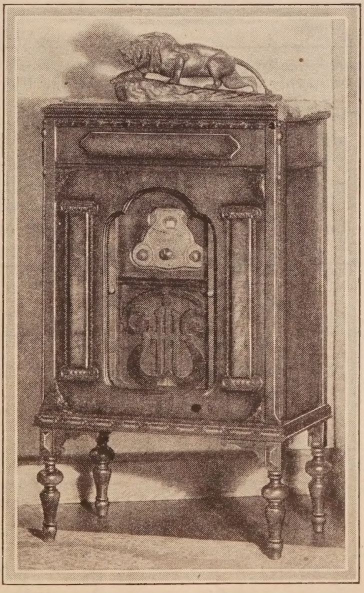

Fig. 2. This is but one of the many attractive console models in the new Scott line for custom builders

Separate Power Pack

A compact separate unit supplies a. c. voltages to all of the tubes and provides the B and C current to the receiver and push-pull power amplifier. The push-pull stage of the amplifier is incorporated in the power pack instead of the receiver and uses the new 245 power tubes. The power pack uses two 280 full wave rectifiers and has ample capacity for taking care of the field of a 90 volt d. c. dynamic speaker.

All of the tubes used are of the a. c. heater type except the 245's and the 280's. The front panel of the receiver is 7 in. by 18 in. finished in harmonious walnut. The depth of the receiver is 10 in. The power pack is 13¾ in. long, 8½ in. deep and 7 in. high.

Schematically the power supply is illustrated in Fig. 4, while the electrical constants of the receiver are set forth in the schematic diagram, Fig. 5. Inasmuch as the receiver is supplied to the Scott representative fully wired, no description of the construction need be given here. However, it is advisable to devote some attention to checking up on connections upon receipt of the receiver.

Condensers Must Balance

On the single dial of the receiver, both condensers are rotated together and if the set is to be efficient over the entire scale, it is necessary that the intermediate frequency amplifier, antenna and oscillator coils and both tuning condensers match each other exactly. If just one of these units is not balanced with the other, the receiver cannot operate to its fullest efficiency. In order to make sure that each receiver is performing at its peak, all of the wiring and matching is performed at the factory.

Upon receipt of the receiver it should be checked very carefully, especially to determine that none of the nuts or contacts have become loose during shipment.

(This receiver tested and all illustrations made in our laboratory)

While the receiver will operate on practically any kind of antenna, it will be found the best operation is secured with one between 70 and 80 feet long, including the lead-in. According to the designers of the set, a good ground is absolutely necessary for the operation of this particular receiver.

Critical I. F. Adjustment

Balancing the receiver, that is the intermediate amplifier portion of it, merits some attention. When all of the tubes have been inserted in the sockets and the set connected to the power pack, the receiver may be turned on by means of the switch on the front panel of the receiver. After waiting about a minute turn the tuning knob in the center until a station is heard. Select a station between 40 and 50 on the dial. Tune it in as loud as possible with the tuner knob, then turn the knob on the left side which is attached to the trimmer condenser until you get a point where the station comes in with maximum volume. Now reduce to moderate room volume by turning the volume control on the right side. While the receiver is balanced in the laboratory, vibration may have loosened up one of the little adjustment condensers in shipment. Tubes will also alter the adjustment of these trimmer condensers slightly. While in the previous models the intermediate frequency was not critical, in the present model it is extremely so and for that reason it is quite essential that the intermediate amplifier be balanced by its owner.

Peaked at 480 Kilocycles

In the present model of the Scott a. c. 10 a frequency of 480 kilocycles has been adopted for the elimination of repeat points.

After the station has been tuned in, take a screw-driver and start adjusting the trimmer at the left-hand of the amplifier or the end where the first shield grid tube is located. Turn the adjustment nut very slightly one way or the other. It will be immediately noticed that the volume will either increase or decrease, but a considerable increase in volume will be found when correct adjustment is hit. This final adjustment should always be made on a station some distance away, never on a local. Also be careful not to turn the adjusting screw very far one way or the other as the entire amplifier will be thrown out of adjustment. The proper adjustment will be that point where the signal comes in loudest. Accordingly each of the trimmers should be adjusted in turn. Because the volume will increase as this correct adjustment is reached, the volume control should be gradually turned back. It is also important that neither the left-hand nor the center knobs on the panel be touched while adjusting the trimmers on the amplifier. The only knob that should be touched is the one controlling the volume on the right-hand side.

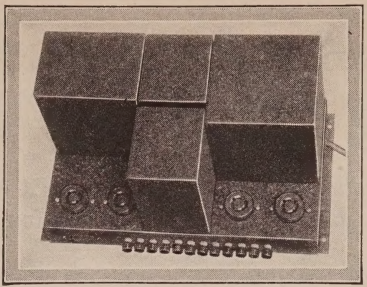

Fig. 3. The power supply used for the World's Record a. c. 10 is photographed above. There are two 280 rectifier tubes used in parallel while the output stage consists of two 245's in push-pull

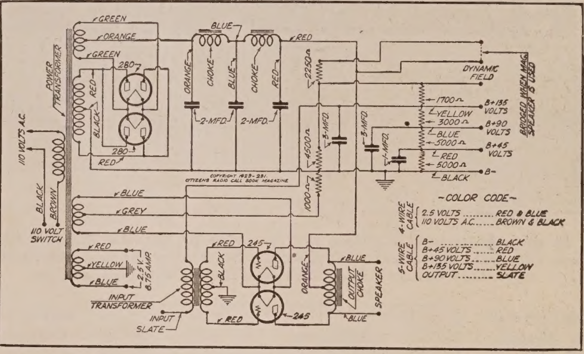
GREEN
ORANGE
GREEN
POWER TRANSFORMER
280
280
RED
BLACK
RED
110 VOLTS A.C.
BLACK
BROWN
110 VOLT SWITCH
BLUE
ORANGE
CHOKE
BLUE
CHOKE
RED
2-MFD.
2-MFD.
2250Ω
DYNAMIC FIELD
BRIDGED WHEN MAG. SPEAKER IS USED
1700Ω
YELLOW
3000Ω
BLUE
5000Ω
RED
5000Ω
BLACK
B+135 VOLTS
B+90 VOLTS
B+45 VOLTS
B−
3-MFD.
3-MFD.
1-MFD.
4500Ω
1000Ω
COPYRIGHT 1929-'30. CITIZENS RADIO CALL BOOK MAGAZINE
BLUE
GREY
BLUE
RED
YELLOW
BLUE
2.5 V. 8.75 AMP.
INPUT TRANSFORMER
INPUT
SLATE
RED
BLACK
245
245
RED
ORANGE
OUTPUT CHOKE
BLUE
BLUE
SPEAKER
~COLOR CODE~
4-WIRE CABLE
2.5 VOLTS .... RED & BLUE
110 VOLTS A.C. ...... BROWN & BLACK
5-WIRE CABLE
B− .... BLACK
B+45 VOLTS ...... RED
B+90 VOLTS ...... BLUE
B+135 VOLTS ...... YELLOW
OUTPUT .... SLATE

Fig. 4. Schematically are shown above the various connections in the power supply intended for use with the World's Record a. c. 10

Use Trimmer on DX

For local reception it will not be necessary to do any adjusting with the trimmer condenser knob on the left side of the receiver. However, this control is very important when tuning for distant stations. It will be found on the high wavelengths the plates on the trimmer condenser are gradually turned in while on the low wavelengths they are gradually turned out.

It is recommended by Scott that his dynamic speaker be used with the a. c. 10 receiver because of its having been designed for this particular set. It is of the 90 volt d. c. type whose field winding is energized from the power supply.

When the receiver and the power supply are mounted in the console, there

(*Continued on page* 132)

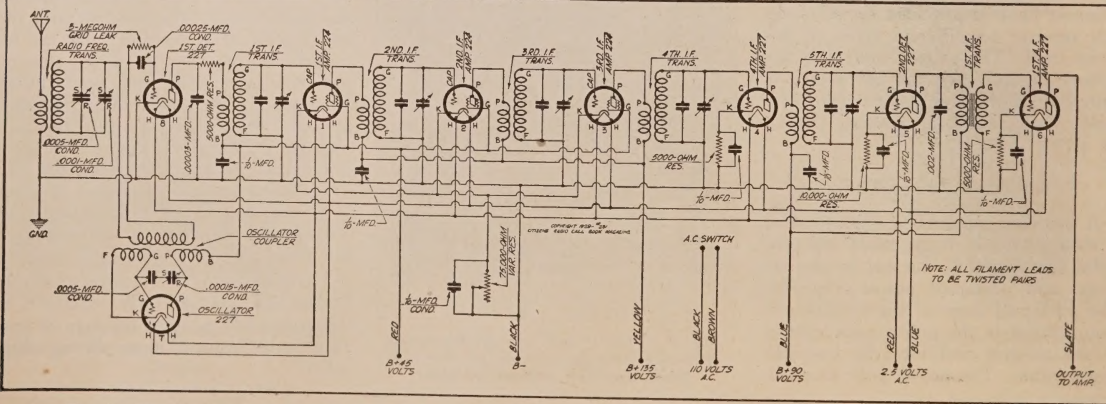
ANT.
5-MEGOHM GRID LEAK
.00025-MFD. COND.
RADIO FREQ. TRANS.
1ST. DET. 227
1ST. I.F. TRANS.
1ST. I.F. AMP. 224
2ND. I.F. TRANS.
2ND. I.F. AMP. 224
3RD. I.F. TRANS.
3RD. I.F. AMP. 224
4TH. I.F. TRANS.
4TH. I.F. AMP. 227
5TH. I.F. TRANS.
2ND. DET. 227
1ST. A.F. TRANS.
1ST. A.F. AMP. 227
CAP
G
P
K
H
S
R
F
B
.0005-MFD. COND.
.0001-MFD. COND.
.00003-MFD.
5000-OHM RES.
1/10-MFD.
5000-OHM RES.
1/10-MFD.
10,000-OHM RES.
.002-MFD.
5000-OHM RES.
GND.
OSCILLATOR COUPLER
.0005-MFD. COND.
.00015-MFD. COND.
OSCILLATOR 227
COPYRIGHT 1929-'30. CITIZENS RADIO CALL BOOK MAGAZINE
75,000-OHM VAR. RES.
1/10-MFD. COND.
A.C. SWITCH
NOTE: ALL FILAMENT LEADS TO BE TWISTED PAIRS
RED
B+45 VOLTS
BLACK
B−
YELLOW
B+135 VOLTS
BLACK
BROWN
110 VOLTS A.C.
BLUE
B+90 VOLTS
RED
BLUE
2.5 VOLTS A.C.
SLATE
OUTPUT TO AMP.

Fig. 5. Electrical connections in the receiver described in this article are shown in the above schematic drawing

Thordarson Push-Pull Amplifier and Plate Supply for 245's

New Design Recently Announced to Give Builders Full Advantage of Latest Power Tubes

WITH the recent announcement of the 245 tube many builders are desirous of either converting existing power supplies into the new type or building them from the beginning. The Thordarson R-245 push-pull amplifier and plate supply described in this article is the latest of the compacts announced by that organization to take care of what appears to be the most interesting power tube yet produced.

Those who have already built a power compact, such as the 210 power amplifier described in the November, 1928, edition on page 51 and the R-480 power amplifier described in the March, 1929, edition on page 61, will observe that basically there is little difference in the electrical connections although there is considerable difference in the results to be obtained.

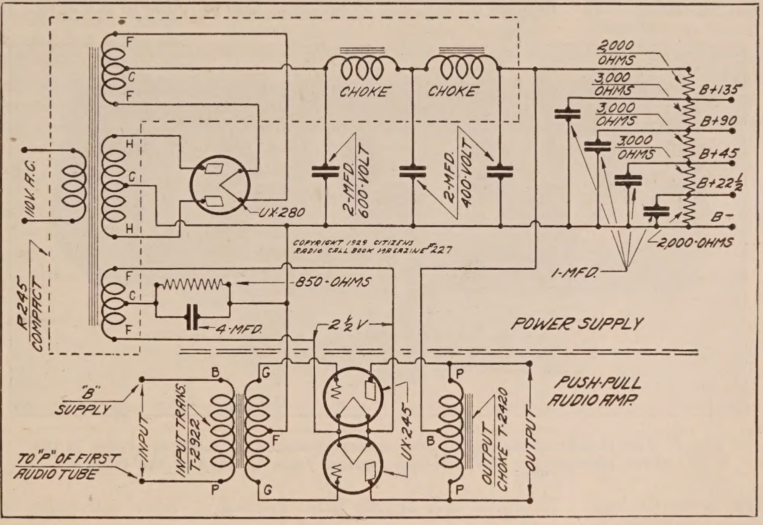

Fig. 1. *This diagram is the complete schematic circuit of the Thordarson R-245 amplifier and plate supply described in this article*

Interesting to Builders

Aside from the virtue of greater undistorted wattage output, the fact that the 245 tube utilizes a possible maximum of only 250 volts, which may be secured from a full wave 280 rectifier, makes the tube and the compact quite interesting from the standpoint of the builder since it eliminates the necessity for extremely high voltages and also reduces the possibility of condenser break-down due to these high voltages.

As will be seen in the schematic circuit, Fig. 1, the R-245 consists of a primary winding of 110 volts, a high voltage supply of 350 volts (no load), each side of a center and a 5 volt center tap filament supply for a 280 type full wave rectifier. The 2.5 volt filament winding will supply two 245 type power tubes and is tapped at the exact electrical center for the grid return. Two chokes with an inductance of 30 henries each are included in the compact, the chokes and high voltage windings having a capacity of 100 milliamperes.

The voltage divider may be Electrad or Ward-Leonard, giving external voltages of 22½, 45, 90 and 135 volts when used with a receiver of normal drain. If heavier drain receivers are used, these voltages will drop somewhat but not below the point of practical operation.

Output Coupling Forms

In the output stage, a T-2880 may be used as an output transformer for a high impedance speaker (cone or horn). In the schematic the T-2420 impedance is shown. If a dynamic speaker is to be employed, the output transformer should be changed for the type T-2903 speaker coupling transformer. When this transformer is used, the output transformer in the dynamic speaker should be disconnected and the movable coil of the speaker connected directly to the output or secondary terminals of the T-2903. If high frequency cut-off is desired, two small fixed condensers of about .02 mfd should be used across the plate winding of the primary of the T-2903 transformer.

Because of the limited output of the rectifier tube, there is no provision for supplying the field of the dynamic. The dynamic if used should either have a 6 volt field or a field operating from alternating current through a rectifier.

This assembly with the first audio tube in the set makes an excellent phonograph amplifier when used with a good electrical pick-up. The pick-up should be connected by using the plug which is furnished with the pick-up and plugged into the detector socket or by connecting across the primary of the first audio transformer with a single throw double pole switch. If an electric motor operates the turn table, the case of the motor should be grounded.

The parts list shown in the accompanying article is for a wooden baseboard assembly with all of the wiring exposed on top. A neater style is recommended as shown in the photograph, Fig. 2. In this layout the resistors are mounted under the bakelite baseboard ¼ x 11 x 14 inches. Most of the wiring is also below the baseboard. This baseboard is supported at the bottom on three sides by panel brackets and by the 2 x 11 x 3/16 inch binding post panel at the front which is fastened

(Continued on page 124)

(This Power Supply Tested and All Illustrations Made in Our Laboratory)

Leutz "Seven Seas" Console Is Made by Expert Radio Craftsmen

Many Custom Built, Tuned R.F. A.C. Screen Grid Models are Exported by Leutz Organization

THE average factory built radio receiver today is a marvel of radio engineering. Compact, efficient, selective, with ample power and splendid tone quality, the modern mass produced receiver is fully equal to all demands of the average home. But, for those who desire something more, something different, distinctive, the factory built set does not quite fill the bill.

For these people, a custom built set, constructed along definite lines, gives that superiority of performance demanded by the discriminating. In designing the Seven Seas Console, the main purpose was to design a set equal in sensitivity and selectivity to the best superheterodynes.

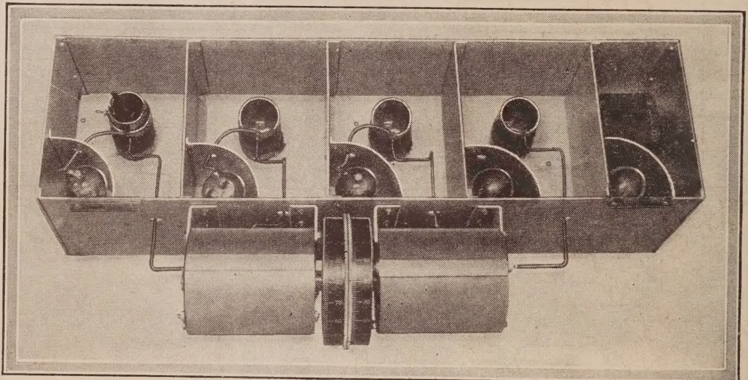

Fig. 1. The chassis of the Seven Seas model produced by Leutz is shown in the above photograph, the view being taken from the top at the front

Super Pioneer

C. R. Leutz introduced the first superheterodyne receiver for broadcast reception, the model L in 1921 and the model C in 1922, these two designs being the basis of most present day superheterodyne receivers. Outside of adapting the designs to modern tubes, very little improvement has been made over the original model L and C designs.

It is not denied that the super has wonderful sensitivity and if properly designed good selectivity if operated some distance from local stations. However with the new a. c. screen grid tubes, it is possible with three or four tuned stages to get the same sensitivity as a good super, 10 k. c. selectivity and tone quality superior to a super. It is also possible, using these tubes in a straight tuned r. f. circuit to eliminate all the faults of a super.

The Seven Seas model, in comparison with a good super at a location having many locals, will give at least equal performance to the super and have the additional advantage of the finest possible tone quality and to be free from "harmonic tuning," long wave telegraph interference, etc.

Sensitivity Is High

The sensitivity of the Seven Seas is very high, using an aerial only a few feet long, it will easily cover 1000-1500 miles, with good loud speaker audibility (this during the summer time). Reports of daylight reception of 500 to 750 miles have already been reported.

The Seven Seas has sufficient overall amplification to operate two 250 power tubes in push pull. While several stages of screen grid r. f. and screen grid detector will operate one 245 power tube to full output, it is not deemed possible to operate two 245 tubes in push pull to full output direct from the detector. The proper design is to have one stage of audio amplification between the detector and the push pull power tubes.

In the Seven Seas there are three stages of tuned r. f. using screen grid tubes, screen grid detector, first audio and push pull power audio using two 250 tubes. The final output is fed into a 12 inch dynamic speaker and if desired two or three additional dynamic speakers could be connected to this set for use externally, in other parts of the home, there being sufficient output for this purpose.

No Shielding Losses

The radio frequency amplifier and its scientific shielding arrangement is entirely different from similar tube setups. Space has not been a consideration, accordingly the shielding has been so designed that there is practically no losses in the radio frequency amplifier due to shielding. In the Seven Seas the shielding system has been designed with a thorough understanding of what is required and this experience dates back to the introduction of the first shielded set for broadcasting by Leutz in 1921.

All three radio and the detector stages are tuned, by special variable condensers which are also entirely shielded. There is another interesting point in connection with the condenser shielding. Leutz built the first single control receiver, licensed under Hogan Patent 1,014,002, a good many years ago. For this receiver an entirely shielded condenser was designed where each stator (or grid) was insulated from the adjoining stator. This allowed the amplifier to be used to very high efficiency. Other manufacturers shortly after made multiple condensers with several condensers on one shaft, but without any shielding between stators and when used in sets they wondered at the cause of stray coupling which prevented satisfactory results.

In coupling the detector to the first audio amplifier transformer, an important idea is used, the parallel plate

(This receiver tested and all illustrations made in our laboratory)

feed. The detector plate is fed through a high inductance choke and resistor in parallel, and the primary of the audio transformer coupled to the plate through a blocking condenser. The blocking condenser blocks the plate current but passes the audio currents which are the only ones required in the primary of the audio transformer. Otherwise if the detector plate current was allowed to pass through the primary of the audio transformer, it being a high grade iron core type, the core would become permanently magnetized to an extent that would cause distortion with age. Eventually the transformer would become useless. The same system is used in coupling the first audio plate to the primary of the push pull input transformer. An additional advantage of this system is that the direct current component can not interfere with or distort the audio currents.

The antenna is coupled to the r. f. amplifier through a variable coupler. This coupler controls the selectivity and can be set for the desired selectivity required for the particular antenna used. This coupling device also has some effect on the sensitivity. For example at a poor location for good reception (dead spot) this coupling would be set as tight as possible for maximum signal strength.

Minimum Servicing

As most Leutz receivers are sold to owners all over the world, it is highly important that the receivers be entirely free from service difficulties. With this essential point in view, all Leutz receivers are very carefully manufactured, inspected and tested, so the new owner upon receiving the radio, simply has to insert the tubes, connect the aerial, ground and power and operate the instrument. All the parts in a Leutz receiver are of the very highest quality, regardless of cost. The ratings of the component parts which are subject to mechanical or electrical strains, are all of a very liberal safety factor. The fixed condensers both in the receiver and in the power pack are of special "self-healing" design. That is, if the condenser were ruptured by an abnormally high surge, this break would automatically heal again and the condenser ready for service immediately. This was an exclusive feature in the early electrical sets for several years and now has been adopted by others.

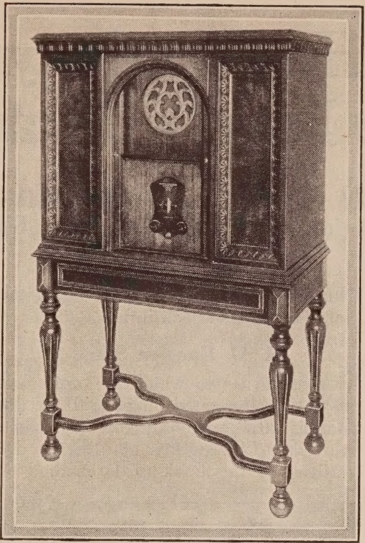

Fig. 2. In the above photograph the Seven Seas receiver has been housed in an attractive console made by Aston

However, if service is required, the Seven Seas is designed so that it can be accomplished with a minimum amount of trouble. The chassis, speaker, audio amplifier and power pack are each built as a unit and each can be removed easily without affecting the other assemblies. With this construction, the defective unit can be removed and returned to the factory without returning the entire receiver. This however, is seldom necessary as the constructional design would permit the individual part to be replaced without returning an entire unit.

The power pack is of heavy capacity because in addition to supplying the heavy current for two powerful 250 tubes, it has to handle the balance of the receiver as well. The plate current drawn by the entire receiver is used to excite the field of the dynamic speaker, this connection supplying the speaker field with practically pure direct current, prevents any "hum" in the

(*Continued on page* 130)

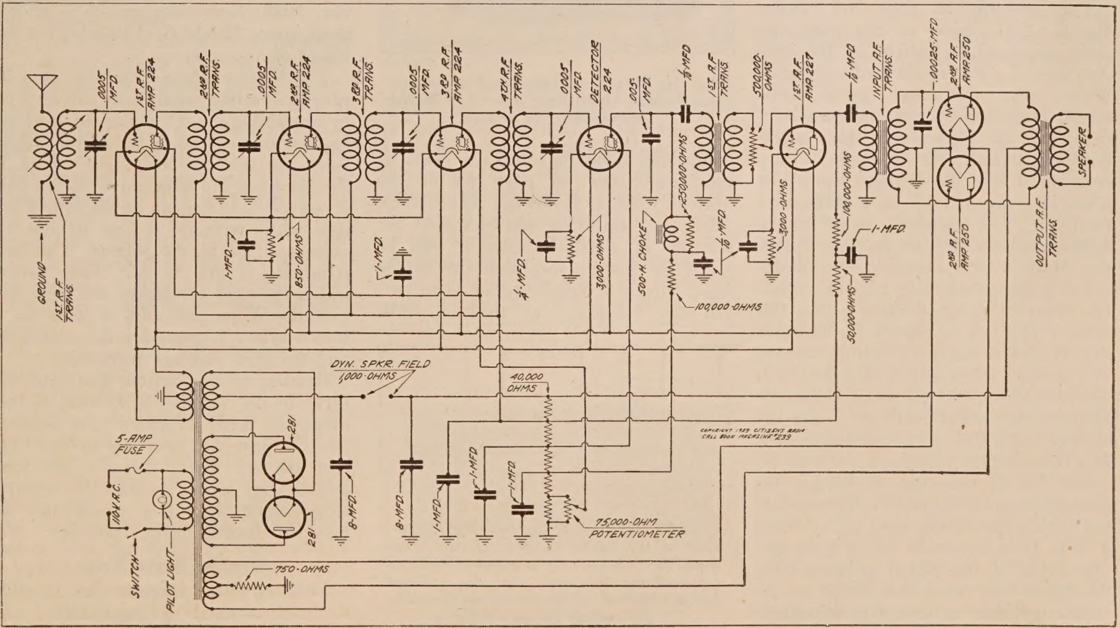
GROUND
1ST R.F. TRANS.
.0005 MFD.
1ST R.F. AMP. 224
2ND R.F. TRANS.
.0005 MFD.
2ND R.F. AMP. 224
3RD R.F. TRANS.
.0005 MFD.
3RD R.F. AMP. 224
4TH R.F. TRANS.
.0005 MFD.
DETECTOR 224
.005 MFD.
1/10 MFD
1ST A.F. TRANS.
500,000 OHMS
1ST A.F. AMP. 227
1/10 MFD
INPUT A.F. TRANS.
.00025 MFD
2ND A.F. AMP. 250
SPEAKER
1-MFD.
850-OHMS
1-MFD.
1/4 MFD.
3000-OHMS
500-H. CHOKE
250,000-OHMS
1/10 MFD
3000-OHMS
100,000-OHMS
100,000-OHMS
1-MFD.
50,000-OHMS
2ND A.F. AMP. 250
OUTPUT A.F. TRANS.
DYN. SPKR. FIELD 1,000-OHMS
40,000 OHMS
281
281
5-AMP FUSE
110 V. A.C.
SWITCH
PILOT LIGHT
750-OHMS
8-MFD.
8-MFD.
1-MFD.
1-MFD.
1-MFD.
75,000-OHM POTENTIOMETER
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Fig. 3. The schematic circuit shown above gives all of the electrical details of the Seven Seas receiver described in the accompanying article

Multi-Unit Has Variety of Uses for Service Man or Radio Fan

Device Made By George W. Walker Mfg. Company Will Obviate Building Separate Units

DESPITE the widespread interest in the construction of individual test units for the service and repair man or the radio experimenter, many have come to the conclusion that the most desirable device would be one which might be put to a number of uses in order to obviate the necessity of having to build several separate units. This fact is readiby brought to mind when one considers the Multi-Unit recently announced by the George W. Walker Mfg. Company of 13301 Durkee Ave., Cleveland, Ohio.

In the March, 1929, issue of this magazine a brief description was given of the various connections with such a unit and to that issue the reader is referred for data showing the various circuits possible with that device.

In this article, however, it is our purpose to show the reader how the single unit may be made to perform in place of several of the units designed in our laboratory for service men and experimenters.

Modulated Oscillator

For example, on page 105 of the March, 1927, issue of this magazine there appeared an article on the construction of a self modulated oscillator. While this particular arrangement served very nicely for an individual desiring to make up a special unit, nevertheless practically the same results may be secured with the Walker Multi-Unit when it is hooked up as a modulated oscillator. The schematic circuit for the audio oscillator appears on page 114 of the March, 1929, issue, being designated as schematic No. 12. The oscillator may be operated either with a 199 tube, a 4½ volt C battery for filament supply and a small 45 volt B battery, or you may use a 201-A tube with a 6 volt A battery and the same B battery as previously mentioned, or if one desires to use a 227 tube operated from a 2½ volt filament transformer it may be done. In all cases the B battery remains the same, the only difference being in the type of tube used and whether it is to be a d. c. tube or an a. c. one. The pitch of the signal generated by the Multi-Unit when connected as an audio oscillator as shown in schematic No. 12 may be varied by changing the value of the grid leak in use.

R. F. Booster Stage

Another use to which the unit may be put is illustrated on page 91 of the March, 1928, issue of this magazine, where the Citizens r. f. amplifier is described. In this hook-up the method of connection shown in schematic No. 1 of the instructions on page 63 of the March, 1929, is followed. The March, 1928, r. f. amplifier was designed for the use of a 201-A tube. It will be noted in this instance that the bridge input circuit is employed so as to permit the balancing of the r. f. tube against the tendency to oscillate. This effect is accomplished by means of a center tapped secondary coil with the tuning condenser across both extremities, one end going to the grid of the tube and the other end going to the neutralizing or balancing condenser which is connected to the plate. The center tap of the inductance is connected to the ground of the set. In the schematic No. 1 on page 63 of the March, 1929, issue it will be observed that the grid leak and condenser are shorted by means of the metal link supplied with the unit.

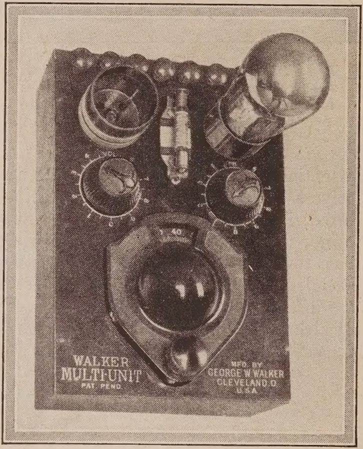


Fig. 1. This is a photographic view of the Walker Multi Unit described in the accompanying article

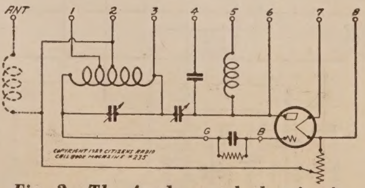


Fig. 2. The fundamental electric circuit in the Multi Unit is shown schematically above. By a combination of connections the unit may be utilized for a number of purposes outlined in the article on this page

Instructions for the balancing of the set are contained in the literature accompanying the unit or if desired the instructions given in the March, 1928, article on the r. f. amplifier may be followed.

Screen Grid Booster

When the screen grid tube was announced many of our readers requested that the r. f. amplifier described in the March, 1928 issue be redesigned for use with the screen grid tube. Accordingly this was done and in the September, 1928, issue on page 76 is shown the Citizens Shield Grid Booster for use ahead of any receiver.

The Walker Multi-Unit may be employed in a like capacity as will be seen by examining the schematic No. 3 which appears on page 63 of the March, 1929, issue. In this case the input circuit is the same but the terminal G of the unit is connected to the cap on the top of the tube while terminal B goes to plus 45 volts applied to the screen. The two terminals B and G are those across which the grid condenser and leak are placed. When the unit is used as a screen grid r. f. amplifier the condenser and the grid leak are removed.

Readers of this article will also observe in the March, 1929, issue of this magazine there appeared two articles, one on page 51 referring to the Citizens Boosters Stage using a 226 tube and another article on page 56 relating to a simple wave trap which may be used for eliminating interference.

Simple Wave Trap

Both of these circuits are feasible

(*Continued on page* 128)

(This unit tested and all illustrations made in our laboratory)

Keystone Electric 67 Is Unwired Kit to Meet Price Requirements

Professional Set Builder May Save Time That is Usually Spent in Assembly and Hooking Up Set

WITH the metal chassis firmly established in the industry as a means of rapid production of sets, to say nothing of unvarying location of parts and standardized wiring, the professional set builder has been at times hard put to find a radio set with which he can compete against factory produced receivers selling at a low price.

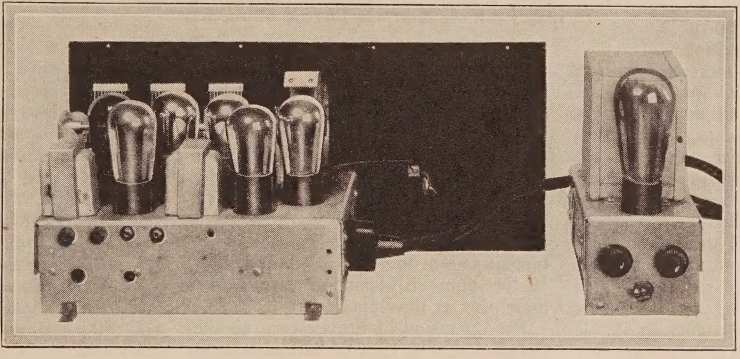


Fig. 1. Rear view of the Keystone receiver and its power supply is shown in the above picture

Built for Price Market

In the past much of the set builder's time was devoted to the assembly of the parts and wiring up the set. In a recent kit announced by the Keystone Radio Laboratories, Inc., all of the necessary parts are in place on the metal chassis and all that the builder need do is to wire up the receiver according to the instructions and the schematic. The receiver is designed primarily as a means of enabling set builders to compete on price where such a possibility did not exist in the past.

Examining the schematic of the receiver shown in Fig. 4, it will be observed that it is a full electric set of the tuned radio frequency type, stability being accomplished by means of the grid suppressors located in the grid circuit of the second and third radio frequency stages.

A three-section gang condenser is used for tuning the second and third radio frequency stages as well as the input circuit of the detector, where a 227 is employed. Individual trimmers are provided on the gang condenser as a means of lining up the tuning unit to compensate for any inequalities in wiring and tube capacities. The input stage from the antenna is untuned. It consists of a 3,000-ohm fixed resistor located between grid and ground, with the antenna connection being made to the grid terminal. Under these conditions the first radio frequency stage becomes a buffer and accomplishes two purposes. The first is: tuning may be performed without having to consider varying antenna load conditions. Second in the event the set should be made to oscillate, it prevents the passage of radio frequency energy back into the antenna circuit.

Each section of the three-gang condensers has a capacity of .00035 which is sufficient to cover the American broadcast range. Volume control for the receiver is a 3000 ohm variable resistance placed across the primary of the second radio frequency transformer. In the detector circuit a .00025 mfd condenser is used as a grid condenser with a three megohm leak from the grid of the 227 to the cathode. The cathode is common with ground as is the rotor of the three-gang condenser and the bottom ends of the three radio frequency transformer secondaries.

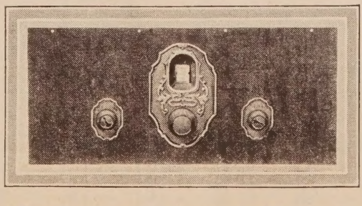


Fig. 2. A simple front panel layout is disclosed in this photograph

In the audio side of the receiver the conventional first and second stage audio transformers are employed, a 226 tube being used in the first audio frequency amplifier, while a 171-A is employed in the power stage. Coupling for the speaker is through a 1 mfd condenser connected to the plate side of an output choke and the junction of the 3000 ohm biasing resistor for the 171 and the 50 ohm center tapped resistance across the 5 volt a. c. filament circuit. The 226 filament line has across it two ½ mfd bypass condensers, whose common connection is grounded. Bypass for the detector circuit is a .002 mfd located between the plate of the 227 and the cathode.

Figure 3 shows the schematic of the power supply which on account of its compactness is supplied fully wired. It is the conventional 280 rectifier circuit consisting of 110 volt a. c. primary, high voltage winding for the plates of the 280, 5 volt winding for the filament of the 280, 1.5 volt secondary for the 226's, a 2.3 volt winding for the 227 and the 5 volt secondary for the filament of the 171. A double choke is used in the positive high voltage line with the necessary bypass condensers across the two ends and the middle. An 85,000 ohm resistor with its attendant bypass capacity drops the voltage to 45, while a 7500 ohm resistor from the high line drops the voltage to 150, the high line with approximately 180 volts being used to energize the plate of the 171 power tube. Across the 2.3 volt filament is a 20 ohm hum balancer while another such unit of the same resistance is placed across the 1.5

(This receiver tested and all illustrations made in our laboratory)

volt secondary for the 226's with a 1250 ohm fixed resistor between the center tap and ground, this being for the grid bias applied to the radio frequency stages.

The photograph shown in Fig. 1 discloses the complete receiver with its power supply at the right. The power supply is connected to the receiver by means of a Jones multi-plug. The front panel view of the set is illustrated in Fig. 2.

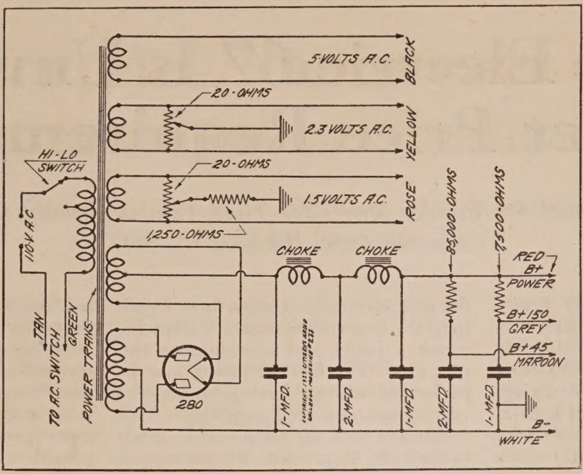

5 VOLTS A.C.
BLACK
20-OHMS
2.3 VOLTS A.C.
YELLOW
HI-LO SWITCH
20-OHMS
1.5 VOLTS A.C.
ROSE
1,250-OHMS
110 V.A.C.
CHOKE
CHOKE
25,000-OHMS
7500-OHMS
RED B+ POWER
B+150 GREY
B+45 MAROON
TAN
TO A.C. SWITCH
GREEN
POWER TRANS
280
1-MFD
2-MFD
1-MFD
2-MFD
1-MFD
B- WHITE

Fig. 3. Above is shown the schematic circuit of the power supply for the Keystone Electric 67 receiver

Operating Suggestions

When the receiver has been wired in accordance with the schematic shown in Fig. 4, this should be thoroughly checked against the schematic to prevent possibility of wrong connections. In order to obviate the possibility of trouble, it is well to test out the receiver and power pack by steps. First insert the plug of the power pack into the receptacle on the chassis and insert the a. c. plug in the nearest light socket. Turn the panel switch which turns on the a. c. for the receiver. If the pilot light does not light an error has been made in the wiring. In this test neither the receiver nor the power pack should have any tubes in it. If the pilot light does light, place a 171-A tube in the socket so marked, then a 227 tube in the five-prong socket and note whether these two light. Then place the 226 tubes in the remaining sockets and see whether they light. Do not put 226 tubes in 171 sockets or tubes will be blown. The operator may now turn off the set switch, connect the antenna, ground, speaker tips, and insert the 280 rectifier tube in the power pack unit. At the rear of the pack is a switch and two knobs. The swich is for adjusting the set to a particular line voltage. If your line voltage is 115 or more turn the switch towards the right. For 105 to 110 volts turn the switch to the left. The two knobs are hum controls. If a hum is heard it may be controlled by turning one or the other of these knobs. If the hum still persists reverse the male plug in the light socket.

For operation of the set turn on the switch and wait from a half minute to a minute depending on the type of 227 tube being used. Turn the dial to 100 degrees and the volume control to the right as far as possible. Adjust hum control until hum has been reduced to a minimum. Turn tuning control slowly until a station has been heard. Tune in the station carefully. Then turn the left compensating condenser as far in as possible. The compensating condensers are small plates located on the gang condenser and are adjusted by simply turning the nuts. Now loosen the tightened compensator until the signal is loudest. Adjust the other compensators in the same manner for maximum volume. Now tune in a weak or distant station at about 50 on the dial and carefully readjust compensators for final fine adjustment. If care is taken in adjusting these compensators, the efficiency of the radio set is greatly increased. Never check any wiring without disconnecting the power pack.

Official Parts List

Parts supplied with the Keystone kit are shown below:

1	Centralab variable resistor 3000 ohm
1	3 megohm grid leak
1	½-½ mfd bypass condenser with filter 1 mfd condenser attached
1	3000 ohm heavy duty resistor
1	3000 ohm flexible resistor
1	3 gang variable condenser
2	Audio transformers
1	Audio choke
1	50 ohm center tapped resistor
1	.002 condenser
1	.00025 condensers
2	500 ohm grid suppressors
1	Jones multi-plug complete
3	Radio frequency coils with strip
1	Dial
1	Dial plate
1	Panel with escutcheon plates
1	A. C. switch

(*Continued on page* 130)

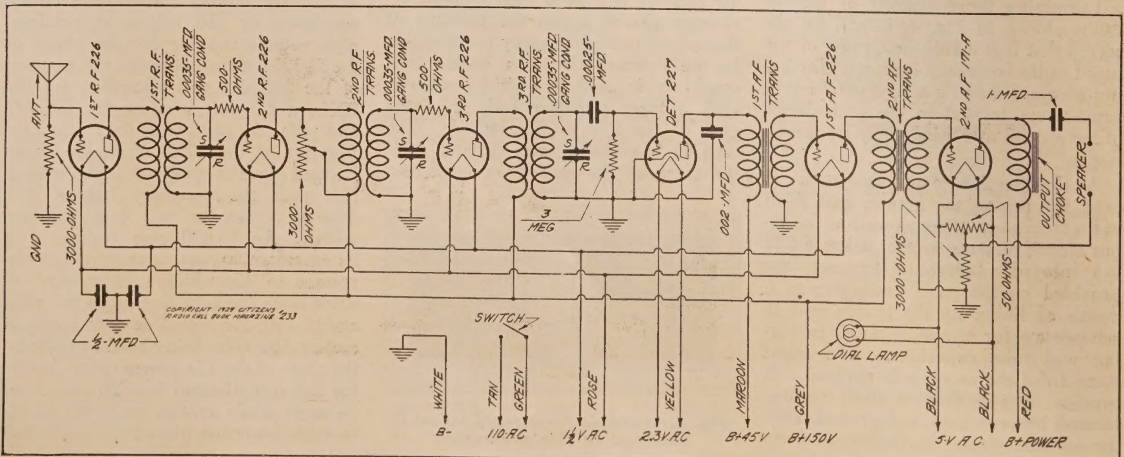

ANT
GND
3000-OHMS
1ST R.F 226
1ST R.F TRANS
.00035-MFD GANG COND
500-OHMS
2ND R.F 226
3000-OHMS
2ND R.F TRANS
.00035-MFD GANG COND
500-OHMS
3RD R.F 226
3RD R.F TRANS
.00035-MFD GANG COND
.00025-MFD
3 MEG
DET 227
.002-MFD
1ST A.F TRANS
1ST A.F 226
2ND A.F TRANS
2ND A.F 171-A
1-MFD
OUTPUT CHOKE
SPEAKER
3000-OHMS
50 OHMS
½-MFD
COPYRIGHT 1929 CITIZENS RADIO CALL BOOK MAGAZINE 233
SWITCH
DIAL LAMP
WHITE
B-
TAN
GREEN
110 A.C.
ROSE
1½ V.A.C.
YELLOW
2.3V.A.C.
MAROON
B+45V
GREY
B+150V
BLACK
BLACK
5-V A.C.
RED
B+POWER

Fig. 4. In this schematic diagram may be seen the electrical constants of the circuit described in this article

H.F.L. "Mastertone" Comprises Many Desirable Radio Features

Uses Five Tuned Screen Grid I. F. Stages and Power Detector with 245 Push-Pull Output

IT has always been the ambition of radio manufacturers to combine into one model outstanding features which a receiver should have without sacrificing circuit efficiency or tonal quality. Designed by the High Frequency Laboratories to take advantage of the amplifying ability of the new 224 screen grid tube, the intermediate amplifier of the Mastertone described in this article represents what is considered the practical limit in both sensitivity and selectivity. The tonal quality realized through a combination of power detection, distortionless coupling and push-pull audio amplification may be considered excellent.

Tube a Great Help

The greatest improvement and progress made in radio frequency amplification in years has been due to the development and perfection of the new screen grid tubes using alternating current. The amplification factor of this tube makes it possible to step up even weak signals to great volume. The new tube is especially adaptable to intermediate stages of a superheterodyne because the tubes are functioning only on one frequency and under this condition means may be taken to insure their stability. Five of these new type screen grid tubes have been employed to advantage in the Mastertone receiver with stability even when the set is operated at full volume.

An inspection of the schematic circuit shown in Fig. 3 will give the reader an idea of the electrical constants and the circuit arrangement. The schematic shown is the one used in the Mastertone model tested in our laboratories and its mere publication does not commit the manufacturer to a strict adherence to published circuit values, since development and production problems may necessitate minor changes.

Aperiodic Input

The input circuit of the Mastertone is of the aperiodic type and permits the operator to use either a very short antenna or copper screen in back of the cabinet or just a metal plate fastened inside at the top of the console. On account of the sensitivity, coast to coast reception should be possible with this antenna arrangement under normal operating conditions. Still louder signals and extreme distances may be secured with an inside or outside antenna. A ground connection is not absolutely necessary because grounding is accomplished through the electric lighting system. The oscillator circuit supplies a given amount of heterodyne voltage to the mixing tube at the low potential side of the antenna circuit.

Five Tuned Filters

The intermediate system employs four screen grid tubes with five tuned filter circuits which are all individually adjustable to the peak frequency at which they are tuned, insuring 10 k. c. selectivity when desired. The highly amplified signal is then applied to a screen grid power detector using about 175 volts on its plate. The power detector feeds into a unity coupled first audio stage which is similar to a resistance coupled stage and capable of amplifying over the entire musical scale. Another advantage of this type of audio coupling is that the entire resistance and high plate impedance necessary for a screen grid detector can be easily applied. In addition this form of coupling eliminates the possi-

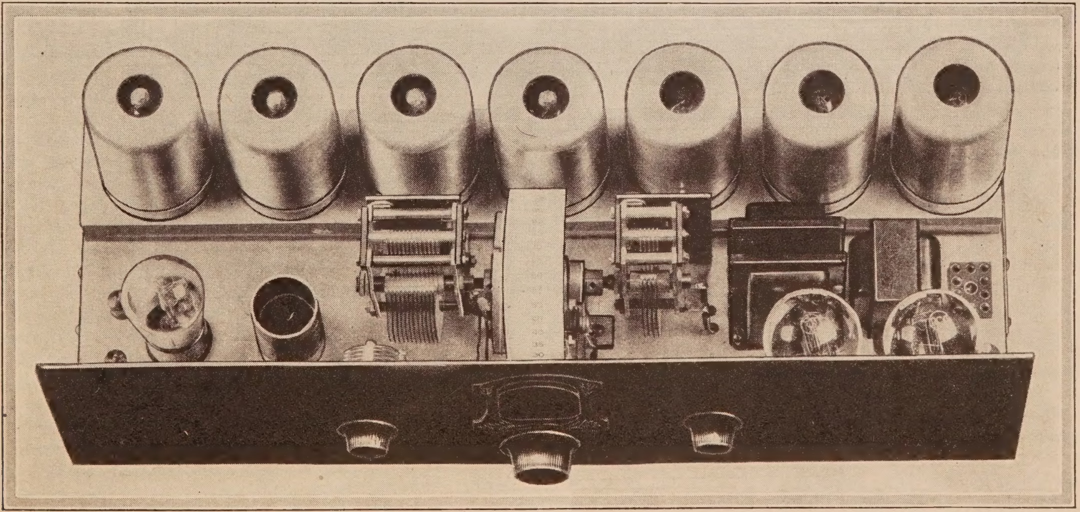


Fig. 1. This is a photographic view of the top and front of the new HFL Mastertone

(This receiver tested and all illustrations made in our laboratory)

bility of picking up a hum in the first audio stage. The first audio stage is followed by a pair of the new 245 tubes arranged in push-pull.

Interspaced Audio Transformer

The push-pull input transformer feeding the two 245 tubes is a new development in audio amplification, being of the newly developed interspaced type whose center becomes the center of the resistance, impedance, inductance and capacity. Primaries of this transformer are wound separately and placed so that a cut-off of all the high noises above the frequencies of the musical scale takes place. The high voltage of the plates of the two 245 tubes is fed through the center tap push-pull impedance, which enables the operator to use any type of loud speaker—dynamic or magnetic, inasmuch as there is no actual B voltage passing through the speaker windings. An electric phonograph pick-up may be plugged into the receiver, which is provided with a plug-in jack. Excellent phonograph reproduction is obtained through the three-stage audio system included in the receiver for phonograph reproduction purposes.

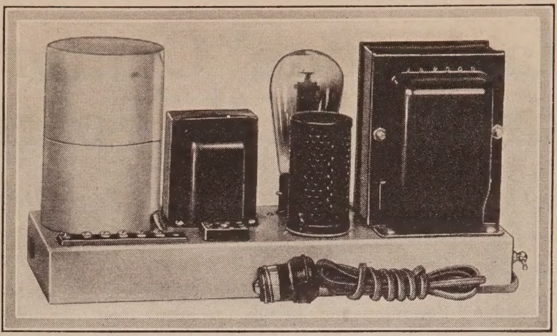


Fig. 2. The power supply which is connected to the receiver by means of a ten conductor cable with connectors at each end is shown in the above picture

The entire receiver is sturdily constructed. In the front part of the chassis cadmium plated steel is used, while the catacomb of the chassis is constructed of heavy cadmium plated copper. All stages as well as all tubes are individually shielded. The catacomb houses all intermediate stages, the detector, the first audio and the oscillator circuit. As a whole the receiver is quite compact, the front panel size being 7 in. by 21 in. The chassis is 7½ in. deep, making it quite easy to install in almost any type of cabinet whether table or console.

Self-Healing Condensers

The power supply which furnishes all voltages for the receiver embodies the latest developments in power practice. A large oversized power transformer is used, the filter system being equipped with a heavy choke and the new self-healing Mershon condenser having a capacity of 24 mfd. The power supply is also equipped with an automatic line ballast taking care of fluctuations from 85 to 130 volts and so arranged that it may be switched out of the circuit in case regulation is not required. The rectifying tube is the full wave 280 type.

10 Wire Cable Connector

Ample provisions for the dissipation of heat have been made. Provision to supply voltages to either an a. c. or d. c. type dynamic speaker has also been made. If a d. c. type dynamic is used, the one having a 2400 ohm field coil using approximately 50 to 55 mils is recommended. Terminals are arranged for the use of either type of speaker. The Jones 10 wire cable with plug-in terminals on both ends connects the power pack to the receiver. Both the receiver and the power unit are completely wired and tested at the factory.

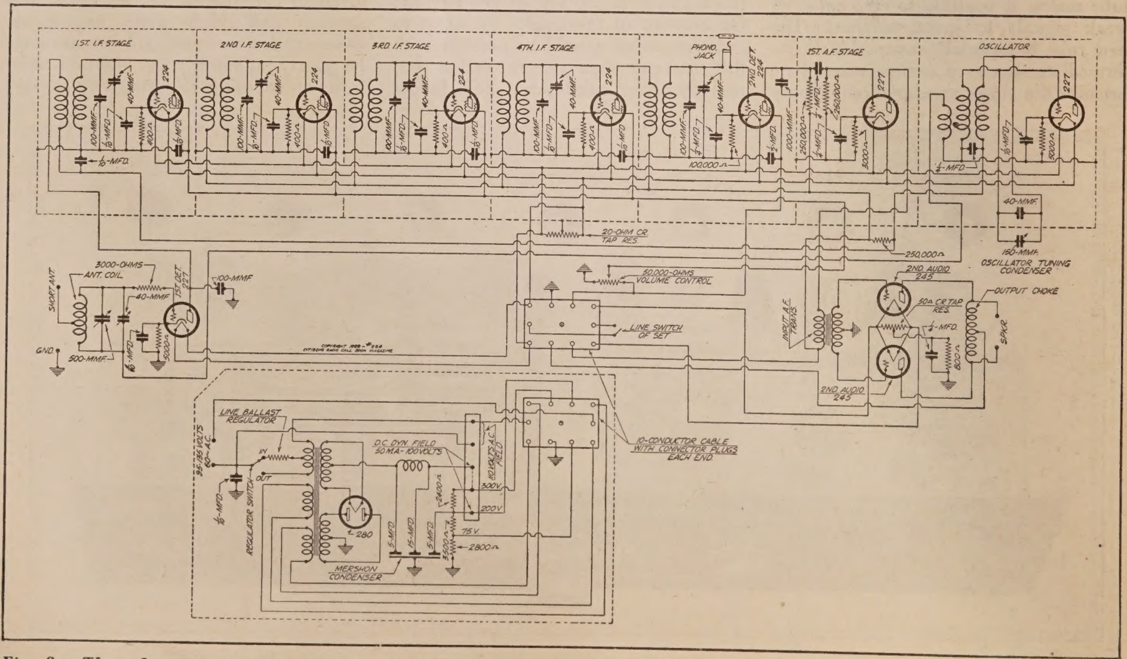

1ST. I.F. STAGE
2ND. I.F. STAGE
3RD. I.F. STAGE
4TH. I.F. STAGE
PHONO. JACK
2ND. DET. 224
1ST. A.F. STAGE
OSCILLATOR
224
227
100-MMF.
1/10-MFD.
40-MMF.
400-Ω
1/10-MFD.
100,000-Ω
1000-MMF.
250,000-Ω
1/4-MFD.
3000-Ω
1/2-MFD.
1/4-MFD.
5000-Ω
40-MMF.
150-MMF.
OSCILLATOR TUNING CONDENSER
20-OHM CR. TAP RES.
250,000-Ω
SHORT ANT.
3000-OHMS
ANT. COIL
40-MMF
1ST. DET. 227
100-MMF
GND.
500-MMF.
1/10-MFD.
5000-Ω
COPYRIGHT 1929 - #254 CITIZENS RADIO CALL BOOK MAGAZINE
50,000-OHMS VOLUME CONTROL
LINE SWITCH OF SET
INPUT A.F. TRANS.
2ND. AUDIO 245
50Ω CR TAP RES.
1/4-MFD.
800-Ω
OUTPUT CHOKE
SPKR.
2ND. AUDIO 245
LINE BALLAST REGULATOR
95-135 VOLTS 60~ A.C.
IN
OUT
1/10-MFD.
REGULATOR SWITCH
D.C. DYN. FIELD 50 M.A.-100 VOLTS
110 VOLTS A.C. FIELD
300V.
200V.
75 V.
2400-Ω
3500-Ω
2800-Ω
280
5-MFD.
15-MFD.
5-MFD.
MERSHON CONDENSER
10-CONDUCTOR CABLE WITH CONNECTOR PLUGS EACH END

Fig. 3. The schematic circuit of the Mastertone tested in our laboratory is shown above. The mere publication of this schematic does not imply strict adherence on the part of the manufacturer to the electrical values given herein since future development and production problems may require minor resistance or capacity changes

Lincoln 8-40 Super Now Designed for 224 A. C. Screen Grid Tube

Tuning of Intermediate Primary Allows Greater Amplification When Used With New Tubes

JUST a year ago announcement was made of a new design in the superheterodyne circuit. This receiver, "The Lincoln 8-80" (described in our November, 1928, issue), immediately gained wide popularity due to several features for which every "super" fan had been looking—a successful tuned intermediate transformer; absence of harmonics; capability of high amplification with extreme selectivity without regeneration or oscillation; using four screen grid tubes without shields.

At this time practically all of these features were new and untried in the hands of the setbuilder. Production over a period of one year has proved that the basic principles in the Lincoln 8-80 were well founded.

Opened New Field

The advent of the a. c. screen grid tube and the ever growing demand for strictly a. c. operated sets opened up a new field for thought, and the Hollister AC-8 (March, 1929, issue) was designed using four a. c. screen grid tubes in conjunction with the Lincoln 101 I. F. transformers used in the Lincoln 8-80. Good stability was obtained with high amplification and selectivity when used with Shield-plate 122-a. c. tubes.

Early this spring the new specifications for the 224 tube were released and it was noted that this new tube had radically different characteristics and higher voltages with a higher amplification factor than the old tubes. It was then decided to start from the ground up and again design an entirely new I. F. amplifier especially adapted to the new tube characteristics.

A heavy copper case 5 inches high, 11 inches long, and 3⅜ inches wide with four compartments enclose the three tuned transformers; the last compartment housing the audio transformers. The final design of the new I. F. transformers is so radically different from the conventional type that it will be interesting to go into a detailed description.

No wood or low dialectric substance is used. The primary winding is composed of 470 turns of No. 36 wire wound evenly on a 5 inch bakelite tube having a clearance of one inch from winding end to case. Inside, and at the plate end of the primary winding is placed another bakelite tube on which 100 turns of No. 36 is wound for the secondary. At the top of the transformer is mounted a .00007 mfd variable condenser which is connected across the primary winding. This condenser is similar in action to the Lincoln No. 101 I. F. transformer, and accurately tunes each stage to the exact frequency desired; at the same time compensating for all different tube capacities and characteristics.

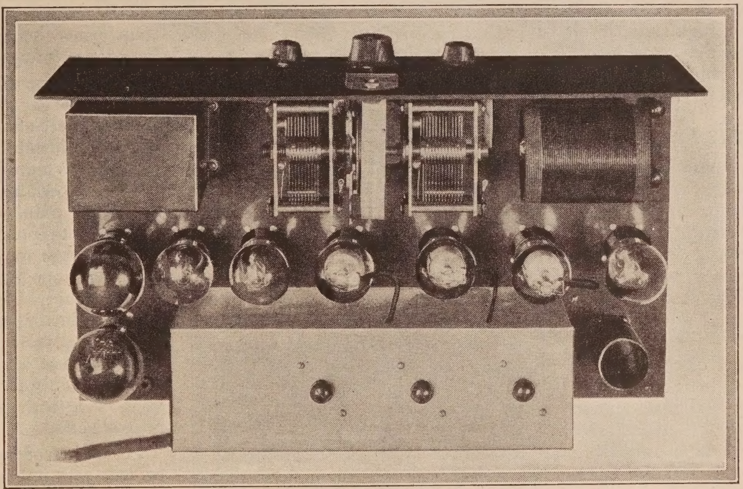


Fig. 1. Above is shown a top and rear view of the Lincoln 8-40 Super described in the accompanying article

Difference in Performance

Fundamentally, the circuit of the new Lincoln 8-40 is the same as the original, but as it is a well known fact the intermediate amplifier of the super circuit is the heart of the receiver, there is a decided difference in the performance in the new and old amplifiers.

Producing an ultra selective receiver can be accomplished with comparative ease, but producing an ultra selective receiver with controlled high amplification is entirely another problem.

In the original design of the Lincoln 8-40, four stages of screen grid amplification were used with the result of a tremendous final amplification which could not be controlled satisfactorily without oscillation due to the extremely high gain per stage possible in this amplifier. It was then decided to cut out one stage, using only three screen grid tubes. The result was ideal; high gain per stage was possible and perfect control was to be had.

This final design showed far more total gain than any of the previous models and due to the fact that oscillation was perfectly controlled, excellent selectivity was available. The great value of this selectivity was apparent in tuning the new Lincoln 8-40, whereas in all of the previous models stations 10 kc. apart could be separated, in the new receiver there is an absolutely dead spot between these stations with the volume control wide open. For example; tuning WLW—in Chicago—

(This receiver tested and all illustrations made in our laboratory)

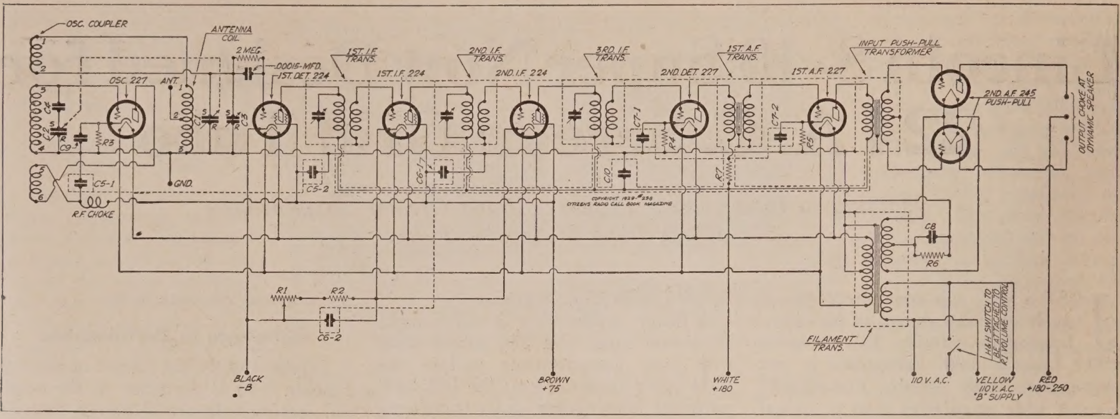


Fig. 2. Electrical characteristics of the Lincoln 8-40 are disclosed in the schematic diagram shown above

shows three dead degrees on the dial between WLW and WGN (local station) with full volume used. KDKA could be brought in with full volume of local 10 kc. away from the local station WCFL. These tests were made in mid-summer with a high static level. Summer reception on the new Lincoln 8-40, in general, was found to be better than winter reception on the previous models.

Push-Pull 245 Stage

The new Lincoln audio utilizes the popular push-pull system with two 245 type tubes in last stage, with 227 type tube in the first stage. Audio transformers are all enclosed in the same heavy copper container with I. F. stages, making a very neat appearance.

Use Any Eliminator

Unique in the history of custom built equipment, the Lincoln 8-40 requires no expensive, especially designed power pack as it will operate satisfactorily with any good B eliminator supplying 75 volts, 180 volts, and 180-250 volts, with no other auxiliary equipment necessary. As most radio fans have this equipment on hand, a decided saving is made possible in initial investment. This is made possible by the fact that a very rugged heater and filament supply transformer is incorporated in the chassis; a very desirable arrangement as no long cable leads are necessary. The windings of this transformer are capable of carrying 100 per cent overload without heating.

Special attention was paid to the antenna and oscillator coils, both being threaded space wound coils of extremely low capacity. These coils are tuned by especially constructed condensers with very low minimum capacity, allowing a range from 190 meters to 550 meters. The two variable condensers operate on one shaft and differences in capacity are compensated by small trimmer condenser which operates with a regular increase as the main control is increased. All biasing resistors are of a comparatively new carborundum composition which cannot be burned out. Volume is controlled by varying the bias on the screen grid tubes, using a smooth 75000 ohm variable resistance.

Choosing Coupling Form

As is known the transformer has proved to be the most practical and efficient means of coupling vacuum tubes for making a cascade amplifier. There are four variations of transformer coupling; namely, untuned, tuned primary, tuned secondary, and tuned primary and secondary.

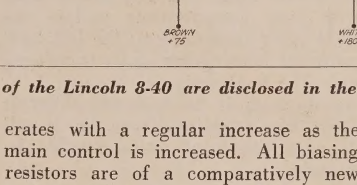


Fig. 3. This photograph shows a front panel view of the completed receiver. The three knobs showing at the top represent the three variable condensers used in tuning the primaries of the intermediate stages

The untuned transformer is very successful in low frequency amplifiers, but at high frequencies, very little gain can be obtained because of the short circuiting effect of the input and output impedance of the 3 element vacuum tube.

At a frequency of 500 kilocycles it is possible to get an impedance of several hundred thousand ohms from a tuned circuit. This impedance increases with both the efficiency as well as the inductance of the coil. In a three-electrode tube with a plate to filament resistance with less than 20,000 ohms it does not take a very large impedance in the primary of the transformer in order to get a considerable portion of the voltage generated across the primary. This means that it does not take very close coupling between the primary and secondary of a tuned secondary transformer to get sufficient reflected impedance into the primary.

It is not possible to get all of the gain out of a transformer when used between three-electrode tubes for a condition of instability and tendency for oscillation appears when the gain reaches a certain value per stage. The maximum gain, of course, would be reached with good shielding, by-passing of each stage to eliminate coupling by common impedance, and neutralizing. There would be no object in using a tuned primary and tuned secondary transformer for coupling three-electrode tubes because all of the gain obtained by tuning only the secondary cannot be used even with perfect shielding and neutralization.

From these considerations, it is very evident why it has been standard practice in designing transformers for coupling three-electrode tubes to use the tuned secondary method.

The four electrode shield grid tube however, has radically different properties from the three-electrode tube. The presence of a shield between the grid and the plate reduces the capacity between the grid and the plate. The shield does not materially change the input capacity which is the grid to filament capacity, but the plate to filament capacity is considerably increased.

This means that the short circuiting effect of the output capacity of a shield grid tube is several times the short circuiting effect of its input capacity. Since tuning either the primary or the secondary of a transformer has the effect of removing either the output capacity or the input capacity respec-

(*Continued on page* 131)

Remler Produces New Design in Type "111" Receiver and Supply

A. C. Screen Grid R. F. and Power Detector With Two First Audio 227 Tubes Used in Parallel

MARKING a change in the design of radio parts, the Remler type "111" receiver about to be described, has several distinguishing features, among which are quality reception, greater selectivity than most of the factory built sets and electrical as well as mechanical efficiency and sturdiness. It is designed to give the user perfect separation of local programs and a reasonable amount of DX reception. Operation of the receiver is, of course, all electric.

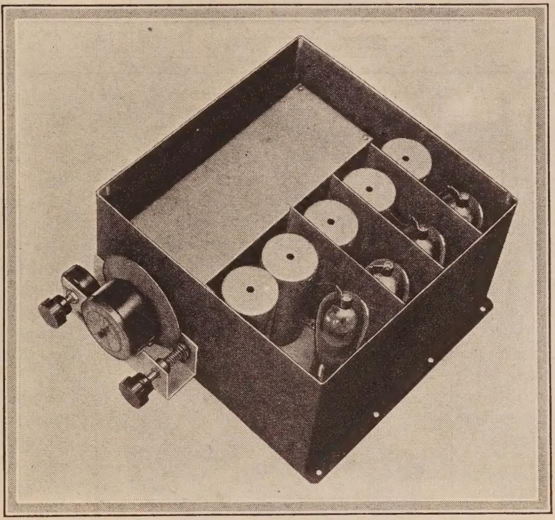


***Fig. 1.** In this photograph is shown the radio frequency end of the type "111" receiver which is a separate unit*

The cases housing the receiver, and the power amplifier and power supply units are of pressed steel finished in brown crystalline enamel. All circuits are thoroughly shielded. Each coil is enclosed in an individual aluminum container. All bypass condensers, resistors and chokes used in the receiver unit are enclosed in a single metal container which is mounted under the plate carrying the coils and tube sockets and from which extend colored leads for connection to the various receiver components.

New Gang Condenser

The tuning condenser is a five-gang condenser of entirely new, heavy-plate, counterbalance construction. The characteristic Remler "twin-rotor" is retained in modified form, each set of plates being entirely insulated from every other set of plates and both sets of plates in a given section rotating. The entire condenser is enclosed in a metal container and is thus fully shielded from external units and, in addition, each condenser section is itself entirely shielded. The tuning characteristic is a modified one. At the lower end of the scale it is SLF and gradually tapers off into SLW, becoming pure SLW in the neighborhood of 300 meters. It is then SLW from that point to maximum. This composite characteristic provides maximum dial separation of stations over the full broadcast band.

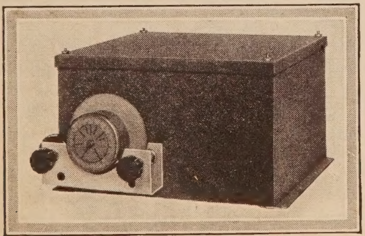


***Fig. 2.** This shows the r. f. unit with the shield cover in place*

In the power amplifier and plate supply unit, a single container houses the audio transformers, the power transformer, the filter chokes and the filter condensers. The transformers are so oriented that their fields oppose. Leads extend from this container for connection to the various other components mounted on the amplifier chassis.

Original Dial Design

The single dial of the 111 receiver is worthy of special mention. It is of most original construction, is illuminated from within and mounts so that its face is flush with the surface of the panel. It is of the full-vision type and its construction is such that discs having the principal station call letters for any district recorded on them by a photographic process can be supplied. The face of the dial is 2¼ in. in diameter.

The type 111 receiver and amplifier units are quite compact. The receiver unit case is only 11 in. wide over the mounting flanges, 10 1/8 in. deep and 6 1/16 in. high. The overall dimensions of the power amplifier and power supply unit case are: length 17 in. over the mounting flanges, depth 6 3/16 in., height 6¼ in. The two units are small enough to be conveniently mounted in practically any standard radio or radio-phonograph combination cabinet. Connections are provided so that, by the installation of a jack, the amplifier unit can be used with any electric phonograph pick-up.

The receiver unit is supplied from the factory in two major parts while the power amplifier and power supply unit is also delivered in two parts.

No Complicated Adjustments

There are no complicated adjust-

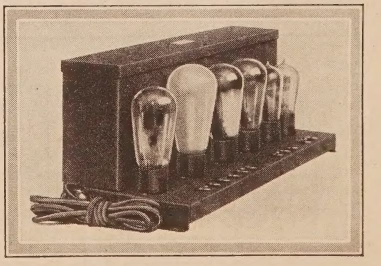


***Fig. 3.** The power pack containing the rectifier, the audio tubes and voltage regulator tube is illustrated above*

(This receiver tested and all illustrations made in our laboratory)

ments to be made after assembly and wiring have been completed. Balancing condensers mounted at the tops of the coil forms are adjusted at the factory so the radio frequency circuits are properly lined up. The only adjustment which must be made at the time the set is put into operation is that of a balancing condenser, located at the top of the coil nearest the tuning dial, which serves to compensate for the characteristics of the particular antenna system used.

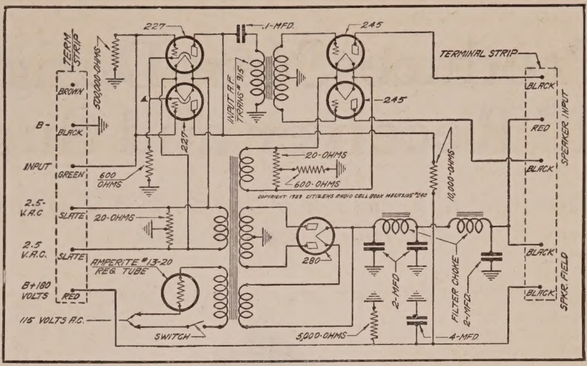

227
.1-MFD.
245
TERM. STRIP
500,000-OHMS
BROWN
B-
BLACK
INPUT
GREEN
600 OHMS
2.5- V.A.C
SLATE
20-OHMS
2.5 V.A.C.
SLATE
AMPERITE #13-20 REG. TUBE
B+180 VOLTS
RED
115 VOLTS A.C.
SWITCH
227
INPUT A.F. TRANS # 915
20-OHMS
600-OHMS
COPYRIGHT 1929 CITIZENS RADIO CALL BOOK MAGAZINE #240
280
2-MFD.
5,000-OHMS
4-MFD.
FILTER CHOKE
2-MFD.
10,000-OHMS
TERMINAL STRIP
BLACK
245
RED
BLACK
SPEAKER INPUT
BLACK
BLACK
SPKR. FIELD

Fig. 4. Electrical details of the power supply and the audio amplifier are contained in the above schematic

The power supply unit of the type 111 receiver not only supplies all necessary power for the receiver but also supplies field current for a dynamic speaker of the 90-110 volt d. c. concert type. It will not deliver adequate power to the field of the auditorium type of speaker but this speaker is usually sold with its own field supply. If a speaker with a separate power supply for the field is used, it is merely necessary to connect a 2000 ohm, 30 watt fixed resistor in series with the leads which would otherwise be connected to the speaker field terminals.

Circuit Analysis

The 111 receiver incorporates three stages of a. c. shield-grid radio frequency amplification, and a. c. shield-grid power detector of the grid-bias type, two 227-type heater-tubes in parallel in the first audio stage and two 245-type power tubes in push-pull in the power stage. A 280-type full-wave rectifier tube is employed. Provision is made for an Amperite No. 13-20 Self-Adjusting line voltage control.

The antenna is coupled to the first radio frequency tube through a band-pass selector circuit of the capacity coupled type. This circuit does not consist simply of two tuned circuits isolated except for the inductive and distributed capacity coupling between the inductances of the circuits but it is a true band-pass selector having the rectangular frequency response characteristic of such a circuit. The capacity-coupled type of band-selector was chosen in preference to the inductively coupled type as it was found the capacity-coupled type provided more uniform gain over the broadcast band. Greatest voltage transfer across the coupling condenser occurs at the lower broadcast frequencies or higher wavelengths as the impedance of the condenser is highest at these frequencies. At the higher broadcast frequencies, the impedance of the coupling condenser is lower and the voltage developed across it is consequently lower but increased energy transfer takes place through the distributed capacity between the circuits. The gain over the broadcast band is therefore quite uniform.

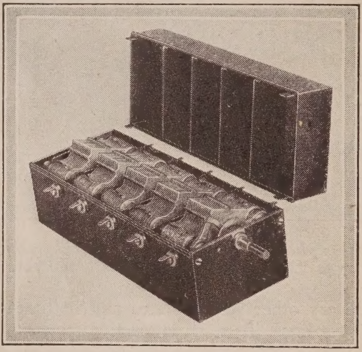


Fig. 5. This photograph is of the five-section gang condenser used in the Remler "111" receiver

Special R. F. Transformers

Radio frequency transformers of special form are used to couple the radio frequency stages. These transformers have large primaries, the natural period of which is above the broadcast band. Since the primary circuit of any transformer resonates at a wavelength above the broadcast band, the voltage developed across the primary increases as the wavelength increases or, in other words, as the primary resonant frequency is approached.

The primary is closely coupled to a few turns of the secondary at the grid end. This coupling provides a certain amount of capacity between the primary and secondary and as the shorter wavelengths or higher frequencies are approached and the voltage developed across the primary becomes less, increased energy transfer takes place through this primary-secondary capacity. The gain over the broadcast band is, through proper determination of the constants of the circuit, held very uniform. These transformer-coupled radio frequency stages are broad in themselves and do not offset the rectangular frequency characteristic advantage gained through the use of the band-selector circuit preceding them.

Ideal Co-ordination

It was found that the use of band-selector circuits throughout was inadvisable because, while they produced a highly selective circuit with an excellent frequency characteristic, they seriously impaired the sensitivity of the

(*Continued on page* 132)

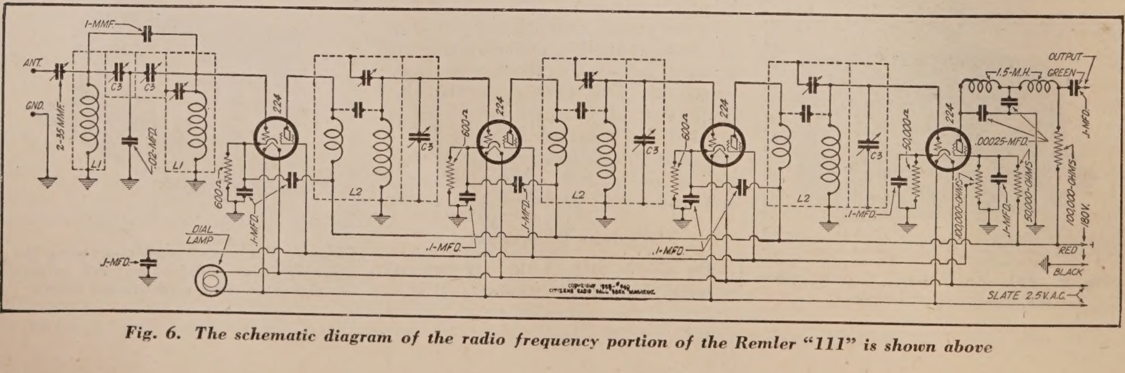

1-MMF.
ANT.
GND.
2-35 MMF.
C3
C3
L1
.02-MFD.
L1
224
600Ω
.1-MFD.
DIAL LAMP
.1-MFD.
L2
C3
224
600Ω
.1-MFD.
.1-MFD.
L2
C3
224
600Ω
.1-MFD.
L2
C3
.1-MFD.
50,000Ω
224
100,000-OHMS
.1-MFD.
50,000-OHMS
.00025-MFD.
1.5-M.H.
GREEN
OUTPUT
.1-MFD.
100,000-OHMS
180V.
RED
BLACK
SLATE 2.5V.A.C.
COPYRIGHT 1929 #240 CITIZENS RADIO CALL BOOK MAGAZINE

Fig. 6. The schematic diagram of the radio frequency portion of the Remler "111" is shown above

Silver-Marshall Seven Thirty-Five Electric Short Wave Set

Six Plug-in Coils for Tuning Over Full Broadcast, Television and Amateur Wavelengths

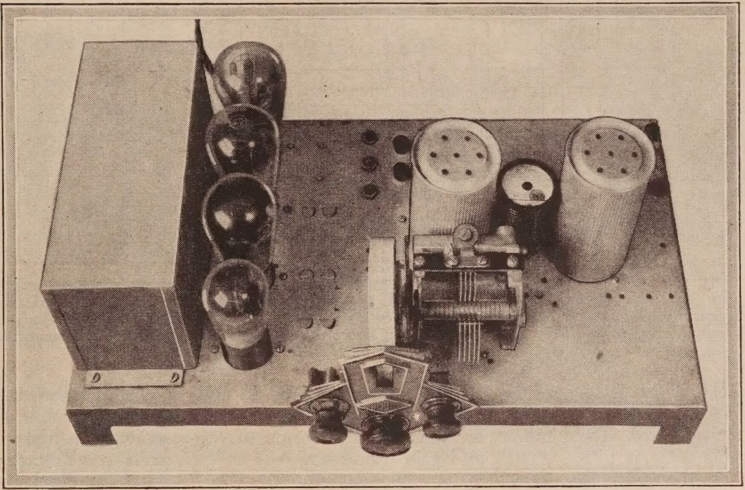


Fig. 1. In this photograph may be seen the chassis of the fully electric Silver-Marshall 735 short wave receiver. The two circular shields are those inside of which are located the screen grid r. f. stage and the 227 regenerative detector

NOT so long ago when radio fans were interested in short wave reception of broadcast programs from this country or from abroad, it was usually customary to intercept these programs on a standard receiver but through the medium of a plug-in adapter. Another means then in vogue was to build up a short wave tuner whose A, B and C supply was provided by the regular broadcast receiver supply.

However, just as the radio public has become intolerant of a multiplicity of controls on their broadcast range receiver, it is only natural that this same intolerance would be extended to include an adapter which had to be plugged into the set in order to pick up short wave stations.

Use Two Sets Now

Today another condition exists which makes it feasible for the listener to have two different sets. Increased engineering facilities and manufacturing economies have resulted in lower priced receivers, giving better gain than heretofore so that now many consider it no longer a burden to own both a short wave and a broadcast receiver, each with its own power supply embodied in the set.

It is interesting to note that advantage of this fact has been taken by Silver-Marshall in the design of their 735 all electric short wave receiver. With such a set it is no longer necessary to worry about the power supply or plugging in on the main set. In fact in many cases the broadcast listener has a regular set in the living room and for his own amusement has a complete short wave receiver in his den, workshop or bedroom. Inasmuch as all of the sets now popular are electrically operated, they may be operated in any location where a wall socket exists, providing, of course, that the current is alternating.

Uses Standard Chassis

Model 735 short wave receiver illustrated photographically, schematically and graphically in this article is constructed upon the same type 721 chassis that is used for the model 722 Band Selector which is described elsewhere in this magazine. It also employs the same ABC power supply and audio amplifier.

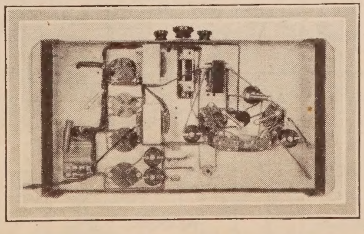


Fig. 2. The bottom of the Silver-Marshall 735 chassis is photographed as shown above. The job is quite easy to wire up and after all connections have been made the leads may be cabled or laced together with string or twine

The receiver circuit consists of one stage of untuned radio frequency, followed by a tuned regenerative detector circuit. By means of six plug-in coils it will cover the entire wavelength from 17 to 650 meters. Four of the six coils are provided with the kit, the two broadcast band coils not being marketed with the receiver, being available, however, on order.

Inexpensive and Flexible

The receiver is truly one dial in operation, being provided with an illuminated vernier drum control, on-off switch and the volume control. In this model the volume control takes the form of a 75 mmf condenser which provides smooth and even control of oscillation and volume. The performance of the receiver on the lower wavelength band below 200 meters will be very pleasing to those fans who have used previous available types of short wave receivers, while its performance on the broadcast band is of an extremely satisfactory nature where high quality or medium distance reception only is desired from this extremely inexpensive and yet highly flexible receiver.

Referring to the schematic diagram shown in Fig. 4, the reader will observe that the input of the radio frequency amplifier 224 tube is aperiodic being

(This receiver tested and all illustrations made in our laboratory)

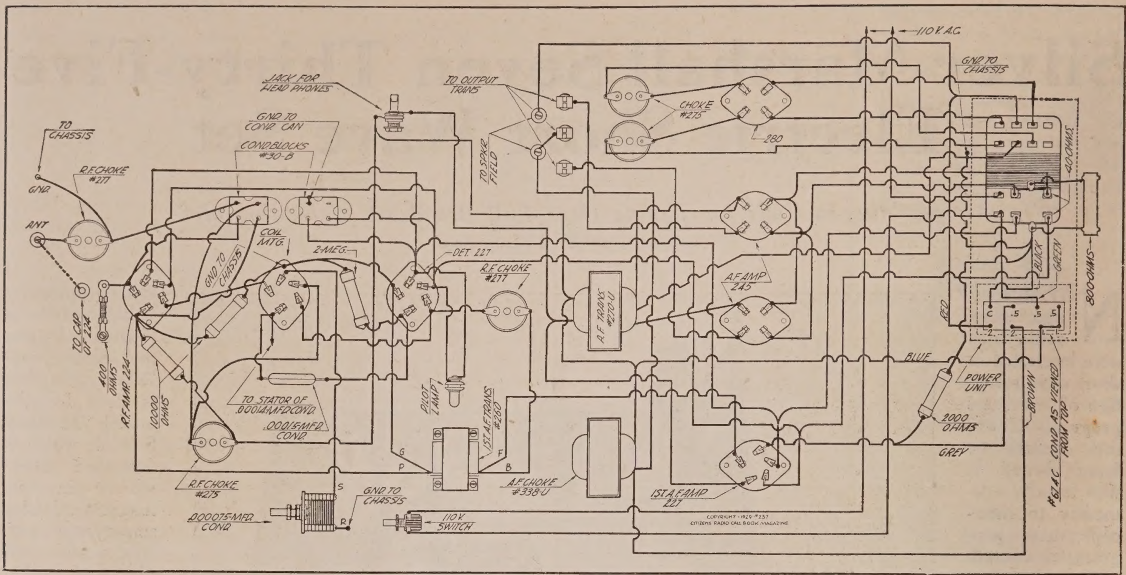

JACK FOR HEAD PHONES
TO OUTPUT TRANS
GND. TO COND. CAN
COND. BLOCKS #30-B
TO CHASSIS
R.F. CHOKE #277
GND.
ANT.
TO CAP OF 224
400 OHMS
R.F. AMP. 224
10000 OHMS
COIL MTG.
GND. TO CHASSIS
2-MEG.
DET. 227
R.F. CHOKE #277
TO STATOR OF .00014 MFD. COND.
.00015 MFD. COND.
R.F. CHOKE #275
.000075 MFD. COND.
S
R
GND. TO CHASSIS
110 V. SWITCH
PILOT LAMP
1ST. A.F. TRANS. #260
G
P
F
B
A.F. CHOKE #338-U
TO SPKR. FIELD
A.F. TRANS. #270-U
A.F. AMP. 245
1ST. A.F. AMP. 227
COPYRIGHT - 1929 - #237 CITIZENS RADIO CALL BOOK MAGAZINE
110 V. A.C.
CHOKE #275
280
GND. TO CHASSIS
40 OHMS
800 OHMS
BLACK
GREEN
RED
C
.5
2.
1
BLUE
POWER UNIT
2000 OHMS
GREY
BROWN
#67 A.C. COND AS VIEWED FROM TOP

Fig. 3. The graphic diagram shown here is the one by means of which the receiver described in this article may be wired up. Whereas in the past it has been possible to wire from the schematic diagram, however, when the assembled chassis is considered it is likely that the builder can make quicker progress by following the graphic illustration as a means of putting in the wiring

across the 277 r. f. choke, which is located between grid and ground with the antenna taken off at the grid end. The bias for the grid of this stage is provided by the drop across the 400 ohm fixed resistance between cathode and ground. This resistance is by-passed by a 1/10 mfd fixed resistor. It will be noted that the primary of the plug-in coil is common at the bottom with the secondary of the coil, the maximum voltage of the eliminator being placed on the plate of the screen grid tube. Terminal C of the coil goes to the plate of the 224, while terminal G of the coil goes to the stator of the .00014 mfd tuning condenser and one side of the .00015 mfd grid condenser.

Regenerative Circuit

The regenerative circuit is that combination of the coil winding marked P and F-1 and the .000075 mfd midget condenser these two being placed in series between the plate of the 227 detector and ground. The P terminal goes to the plate while F-1 goes to the stator of the condenser. The rotor is, of course, grounded. The plate circuit of the detector has a 277 r. f. choke in series with the primary of the first audio transformer and secures its voltage from the same line that feeds the screen grid of the 224, this voltage being dropped from the maximum value by means of the 10,000 ohm fixed resistor between the screen of the 224 and one terminal of the 275 r. f. choke shown in the schematic. The extra 10,000 ohm resistor between the screen and ground is the bleeder resistance. The leak with a value of two megohms, used on the detector tube is between the grid and cathode the latter being common with ground.

Jack For Headphones

In the audio end a 227 is used in the first stage, its bias being supplied by the drop across the 2000 ohm fixed resistor between cathode and grid. This resistor is also bypassed with a ½ mfd condenser. In the plate circuit of the first audio stage is a jack into which may be plugged head phones on occasions when it is not desired to use the speaker. The power stage consists of two 245 tubes in push-pull. The bias for this stage is secured across the 800 ohm fixed resistor lying between the ground and the center tap of the 40 ohm center tapped resistor across terminals Y and Y of the low voltage secondary. The output circuit of these 245 tubes is arranged so

(*Continued on page* 134)

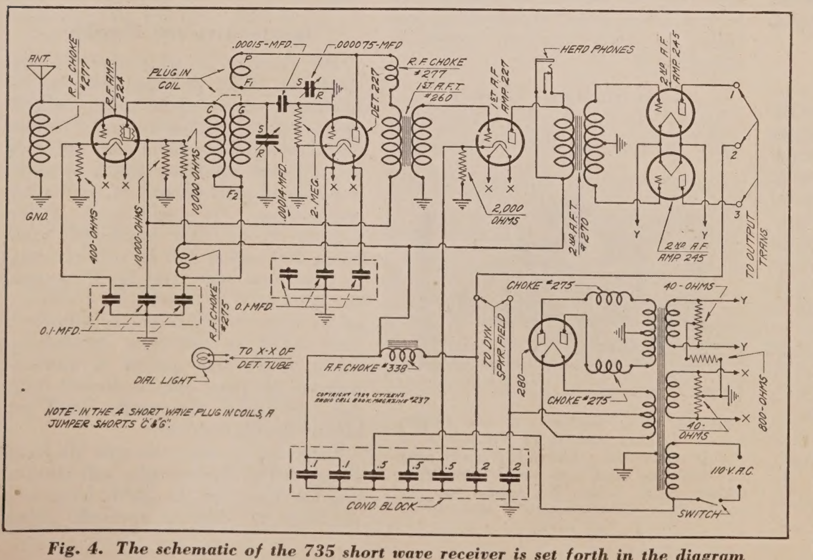

ANT.
R.F. CHOKE #277
R.F. AMP. 224
PLUG IN COIL
.00015-MFD.
.000075-MFD
P
F1
S
R
C
G
F2
GND.
X
400-OHMS
10,000-OHMS
10,000-OHMS
.00014-MFD.
2-MEG.
DET. 227
R.F. CHOKE #277
1ST. A.F.T. #260
1ST. A.F. AMP. 227
2,000 OHMS
HEAD PHONES
2ND. A.F.T. #270
2ND. A.F. AMP. 245
1
2
3
Y
TO OUTPUT TRANS
0.1-MFD.
R.F. CHOKE #275
TO X-X OF DET. TUBE
DIAL LIGHT
NOTE - IN THE 4 SHORT WAVE PLUG IN COILS, A JUMPER SHORTS "C" & "G".
R.F. CHOKE #338
COPYRIGHT 1929 CITIZENS RADIO CALL BOOK MAGAZINE #237
TO DYN. SPKR. FIELD
280
CHOKE #275
40-OHMS
40-OHMS
800-OHMS
110-V.A.C.
SWITCH
.1
.5
2
COND. BLOCK

Fig. 4. The schematic of the 735 short wave receiver is set forth in the diagram printed here

Universal ABC Power Supply With Master Power Amplifier

Audio Amplifier and Power Supply Built as Separate Units for Convenience or Change

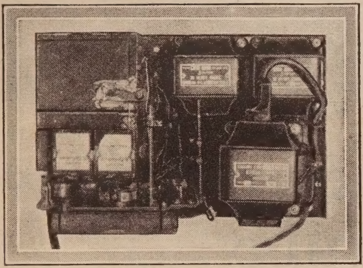


Fig. 1. This picture and the one shown in Fig. 3 are snap-shots furnished by Mr. Jones of his power supply and power amplifier

PRIOR to the recent trend in general radio design, it was the usual procedure to construct the audio-amplifier as an integral part of the receiver proper. However, many radio fans who wish to keep their receivers constantly up-to-date are adopting the system of constructing the power-supply and audio-amplifier entirely separate from the tuner, so that, from time to time as new changes are necessary, they may be made without necessitating an entire rebuilding. This trend is significant in many ways, according to L. R. Jones of Beverly, Mass. First, it allows the use of any of several tuners at will, which is often very convenient. It allows free rein with experimental work, and such experimenting may be done with little or no change in the audio system or the power-supply unit. Also with the perfection of audio amplification, there is becoming less and less need for changes at this point. Tonal and frequency-characteristics have been so improved that flat-frequency response is thoroughly possible with transformers of scientific design. Power tubes of the 171, 210, or 250 type permit the output of any amount of power for all needs. With the present excellence of audio design, further improvement in tonal quality will be contingent upon changes at the broadcast end of the system.

Power Unit Separate

The power unit, supplying "A," "B," and "C" voltages should also be, preferably, a separate unit. By careful design and a slightly increased initial expense, it is entirely practical to build a power unit from which any kind of a receiver may be supplied. Once such a universal power unit is built, it is a permanent piece of apparatus, providing, of course, that each component part is of rugged design and properly selected for the work it is to do. The construction of a separate audio-amplification system and an independent universal power-supply is thoroughly recommended.

It is the purpose of this paper to present information and data involved in the construction of such an independent system, consisting of two parts:

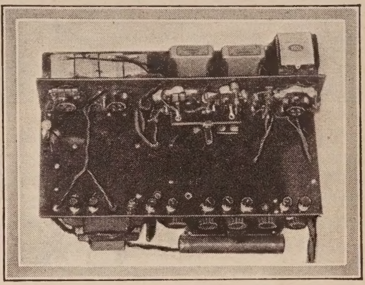
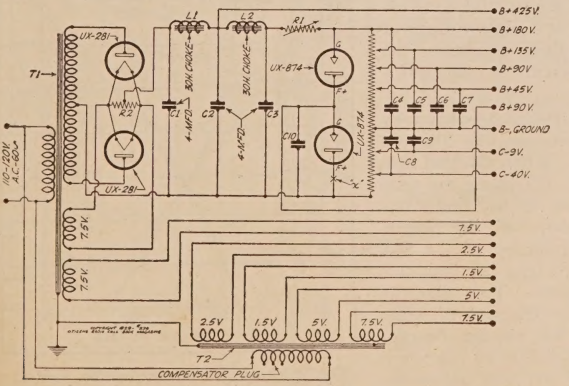


Fig. 3. This photograph shows the audio transformers, sockets, binding posts, etc., of the power amplifier designed by Mr. Jones

Symphonic master audio-amplifier, and the Universal power-supply. Figures 2 and 4 show the schematic circuits for these units. Let us begin with the power supply and cover its salient points of interest.

First, this power unit will supply all "B" and "C" voltages for practically any radio receiver. The use of two 281 rectifiers allows voltage outputs up to 450 volts and permits total plate currents up to 150 milliamperes or more. Through incorporation of two 874 voltage regulators, constant voltage is guaranteed at both 90 and 180 volt terminals. Intermediate values will also be maintained at constant values by inher-

(*Continued on page* 116)



L1
L2
R1
UX-281
T1
R2
30H. CHOKE
30H. CHOKE
C1
C2
C3
4-MFD.
4-MFD.
UX-874
G
F+
C4
C5
C6
C7
C8
C9
C10
UX-874
"X"
110-120V. A.C.-60~
UX-281
B+425V.
B+180V.
B+135V.
B+90V
B+45V.
B+90V.
B-, GROUND
C-9V.
C-40V.
7.5V.
7.5V.
7.5V.
2.5V.
1.5V.
5V.
7.5V.
2.5V
1.5V
5V.
7.5V.
T2
COMPENSATOR PLUG
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Fig. 2. The schematic diagram of the A, B and C power supply is shown above

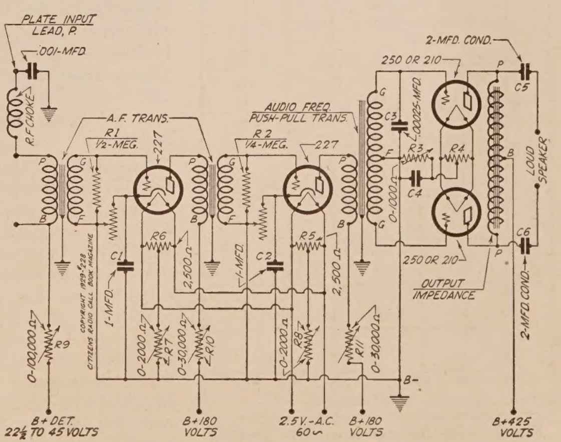
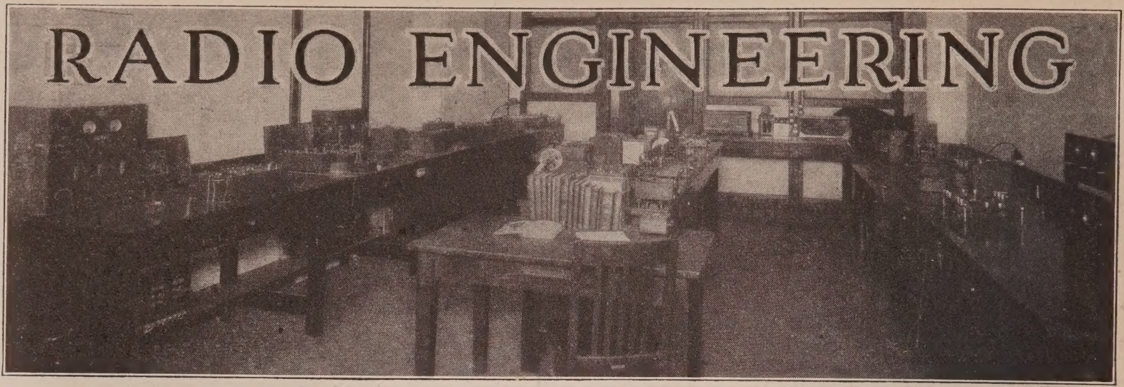


PLATE INPUT LEAD, P.
.001-MFD.
R.F. CHOKE
A.F. TRANS.
R1 1/2-MEG.
227
AUDIO FREQ. PUSH-PULL TRANS.
R2 1/4-MEG.
227
250 OR 210
2-MFD. COND.
C5
C3
.00025-MFD.
R3
R4
C4
0-1000Ω
LOUD SPEAKER
P
G
F
B
R6
R5
C1
C2
1-MFD.
1-MFD.
2,500Ω
2,500Ω
C6
250 OR 210
OUTPUT IMPEDANCE
2-MFD. COND.
0-100,000Ω
R9
0-2000Ω
R7
0-30,000Ω
R10
0-2000Ω
R8
R11
0-30,000Ω
B-
COPYRIGHT 1929-'228 CITIZENS RADIO CALL BOOK MAGAZINE
B+DET. 22½ TO 45 VOLTS
B+180 VOLTS
2.5V.-A.C. 60~
B+180 VOLTS
B+425 VOLTS

Fig. 4. In this diagram is the schematic of the master power amplifier using push-pull output stage



Interesting Possibilities Seen in New UX 245 Power Tube

More Rugged Filament Is Employed; Push-Pull Arrangement Gives Ample Undistorted Output

ANNOUNCED early in the season, the new power amplifier tube CX-345-UX-245 presents many interesting possibilities not only from the standpoint of the manufacturer, but from the angle of the individual set constructor. Such a power tube has been anxiously awaited for some time by the radio industry, because by means of it (due to its filament and plate characteristics) it is possible to simplify the construction of the power end of a receiver.

The 245 is a new loud speaker amplifier tube which will give an output between those obtained from the 171-A and the 250. It has been designed primarily for operation in a. c. sets and for this service has incorporated in it a very sturdy and long life filament. In general appearance, it is similar to the 171-A but with a larger bulb.

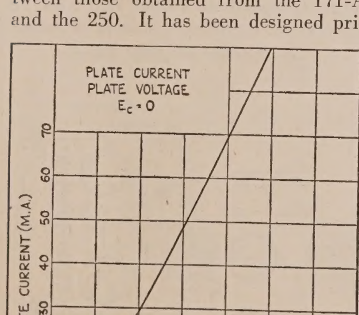


***Fig. 1** gives the average plate current over a range of plate voltages at zero grid bias*

According to a recent engineering bulletin issued by Cunningham, the tube has been designed to operate at a plate voltage of 180 to 250 volts maximum. The grid bias at a 180 volts is 33 volts for direct current operation and 34.5 volts for a. c. operation. At 250 volts the grid bias values are 50 volts and 51.5 volts for d. c. and a. c. operation respectively.

Not Interchangeable

In electrical characteristics, the 245 is similar to the 171-A in that the amplification factor is 3.5, plate resistance is 1900 ohms and the mutual conductance is 1850 ohms at a plate voltage of 250 volts. Under these conditions the average plate current is 32 milliamperes.

The 245 is not interchangeable with the 171 however, because the filament voltage is 2.5 volts. When inserted in a socket designed for 171-tubes, the tube will either burn out or will burn out the filament windings of the power transformer. The filament of the 245 is of a rugged coated type requiring 2.5 volts and 1.5 amperes. This filament has been especially designed to withstand the normal line voltage fluctuation and will give satisfactory life when operated between 5 per cent above the normal rating of 2.5 volts and 5 per cent below the normal rating.

Filament current required will normally be supplied for a 2.5 volt winding on the power transformer, which should be so designed that the voltage across the filament does not at any time exceed 2.63 volts. The plate and grid elements are similar to the plate and grid of the 171-A. The collar construction used on the 250 is not used in this type, since the maximum voltage applied to the plate does not exceed 250 volts. The standard four prong base is employed. It is preferable to mount the tube in a vertical position and provision should be made for free circulation of air around the tube to

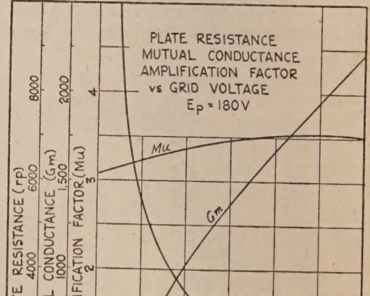


***Fig. 2** shows the amplification factor, plate resistance and mutual conductance plotted in relation to grid voltage and plate voltage of 180 volts*

prevent overheating. The plate of this tube should never under any condition show any visible color due to heating.

Ample Output Possible

The plate voltage on the 245 must not exceed the maximum recommended value of 250 volts. When the power obtainable from one tube is insufficient for volume requirements, two tubes can be used in the conventional push-pull circuit. Operating push-pull with a maximum voltage of 250 volts, the power output obtainable is 3200 milliwatts, which is equivalent to the output obtained from one 250 operated at 400 volts. The distortion in the push-pull circuit with output load resistance of 8000 ohms is less than one-half of one per cent.

The plate and grid voltages can be conveniently supplied from one 280 rectifier obtained at an input voltage of 350 volts per annode. Because of the high voltage and the high plate current an output coupling device, either transformer or choke-condenser, is recommended.

This tube is particularly free from gas and may be operated with the grid circuit resistance of 1 megohm or less. Because of this condition, the tube may be operated in a resistance coupled amplifier.

The tube must not be operated without a C voltage and precaution must be taken to prevent the loss of negative grid voltage, which will cause the 245 to become overloaded and also the rectifier tube supplying it.

As will be the condition in most cases it is desirable that the bias required for the tube be supplied from the drop across the resistor in series with minus B return. It will be found that this connection compensates almost completely for the changes in plate voltage, which may occur as result of line voltage variations, as an increase in plate voltage causes a small increase in plate current, which in turn raises the applied C bias sufficiently to compensate for the new value of plate voltage.

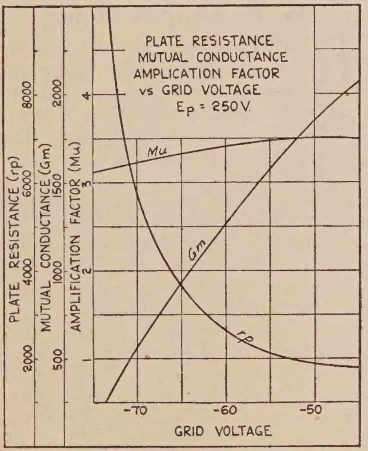


Fig. 3 shows the amplification factor, plate resistance and mutual conductance plotted in relation to grid voltage and a plate voltage of 250 volts

By consulting the table given herewith, which shows the average tube characteristics, it will be observed that the C bias resistor for a plate voltage of 180 should be 1350 ohms, while the bias resistor when using a plate voltage of 250, should be 1600 ohms.

Another interesting feature of the tube is the fact that when a plate voltage of 180 is used, the undistorted output of a single tube is only 750 milliwatts, whereas when the plate voltage is increased to 250 volts, the undistorted output is a little more than double, being 1600 milliwatts.

Three Curves Given

Three curves are included in the accompanying article, Fig. 1 giving the average plate current over a range of plate voltages at zero grid bias, Fig. 2 showing the amplification factor, plate resistance and mutual conductance plotted in relation to grid voltage and plate voltage of 180 volts, and Fig. 3 showing the amplification factor, plate resistance and mutual conductance plotted in relation to grid voltage and plate voltage at 250 volts.

The operating conditions and the average tube characteristics of the 245 are shown in the table below:

Operating Conditions

Filament volts	2.5	
Filament amperes	1.5	
Plate volts	180	
Grid voltage (a. c. filament)	—34.5	—51.5

Average Tube Characteristics

Plate voltage	180	250
Grid voltage (a. c. filament)	—34.5	—51.5
C bias resistor, ohms	1350	1600
Amplification factor	3.5	3.5
Plate resistance, ohms	1950	1900
Mutual conductance, micro-mhos	1800	1850
Plate current, milliamperes	26	32
Undistorted output, milliwatts	750	1600

R.F. Resistance Measurements

By R. K. Pew

Technical Editor

LOSSES which are encountered in a radio frequency circuit are found to be in the form of resistance. The cause and measurement of direct current resistance is of commonplace nature and very probably well understood by all of our readers. However, the cause, effect and measurement of radio frequency is not so well known as is evidenced by the contents of our correspondence.

Varies with Frequency

The resistance of a radio frequency circuit when operated at radio frequencies will vary with the frequency resonant in the circuit. This condition is due to what is called skin effect, which is the tendency of the electrons to flow on the surface of the wire. The resistance of a circuit will, therefore, increase with the frequency tuned. There is another cause of an increase in radio frequency resistance which is known as eddy current loss. If a coil in which there is a radio frequency current flowing has placed near it or in its magnetic field any quantity of metal there will be induced in the metal "eddy currents." If these eddy currents were made strong enough the metal would possibly heat to the melting point. This eddy current loss will have two effects on the circuit. It will reduce the effective inductance of the coil and increase the radio frequency resistance of the inductance.

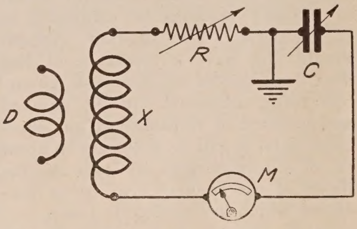


Fig. 4. This sketch represents the circuit used in measuring the high frequency resistance of an inductance or circuit

The resistance of a circuit in the design of a good radio frequency amplifier is essential and, therefore, the measurement of same is important.

Capacity Between Turns

As has been stated in previous articles, the distributed capacity of an inductance is also important from two standpoints. The lower the distributed capacity, the lower the minimum tuning point of the circuit, also the turn to turn capacity of a coil is in reality a condenser and the a. c. resistance of this condenser effect adds to the "skin effect" resistance already existing so it is obvious that in order to obtain a coil of low resistance as possible the distributed capacity should be reduced as much as possible. Again the lower the dielectric constant the lower the capacity. It is, therefore, obvious that if bare wire is used the capacity would be lower than if a covered wire were used, as air has the lowest dielectric constant.

Two Measurement Methods

There are two major methods for the measurement of the high frequency resistance of an inductance or circuit. Both methods are of the current variation type and require considerable care in the operation of the equipment while the measurements are being made. In both methods the same equipment is used to make the measurements.

The first method is the more simple and rapid than the second but is not as accurate.

First Method

The first essential is a good radio frequency oscillator or driver, one whose output does not vary and preferably one which operates from batteries, as this type is considerably more stable in reference to frequency and output than one which is operated by a. c. Second it is necessary to have a calibrated resistance with a range of from approximately one-tenth of an ohm to about fifty ohms. It is absolutely essential that this resistance be non-inductive. Third, the thermo-coupled meter should to simplify readings be calibrated in milliamperes. The thermo element should also have a resistance of less than the expected resistance of the circuit being measured. In the case of measurement of resistance of an inductance only, it will be necessary to know the d. c. resistance of all leads and the losses of the condenser or use a condenser which has negligible losses.

In the sketch will be found the circuit used in both methods of measurement.

In setting up the equipment to make the measurement, the connections should be made as illustrated in the schematic circuit. The coil should be placed in a semi-permanent position and at such a distance from the condenser and resistance that it will not be effected by hand capacity. It is also important that the ground connections be made at the point shown. The connecting wires should be placed in such a manner that they will not move after the measurement is started, as this would in all probability change the various capacities to some extent. It might be well to use bus bar for this purpose.

How to Do It

The first and most simple method of making these measurements is as follows:

Suppose that the circuit to be measured is one as used in a broadcast receiver. Start the oscillator and tune it to exactly 1500 kc. Then rotate the test circuit condenser dial until a resonance point is approached, which will be indicated by a rise in the thermo-coupled milliammeter. When the maximum reading is obtained the resonance point is reached. Reduce the coupling between the test coil and the driver to such a point that approximately 60 m. a. reads on the meter. It is absolutely essential that the exact point of resonance is found, as if the two circuits are slightly out of resonance the resistance reading will be high and false. Note the reading on the meter and then add enough resistance to cut this reading exactly in two. Now then we know by Ohms law that in any circuit if we *double* the resistance the current will be *halved.* Therefore, since we have added enough resistance to halve the current, we have doubled the resistance. From this we see that the amount of resistance we have inserted into the circuit is the amount of resistance originally in the circuit less the resistance of the thermo-couple.

Use Loose Coupling

Another precaution to be observed is that the coupling between the driver and the test circuit is not too tight. When coupling is too tight, too much power will be drawn from the oscillator and the output will not be constant. A good method of checking against this condition is to make a measurement and then repeat, using less coupling. If the results are the same in both cases the coupling is not too tight. Otherwise reduce the coupling until the results check.

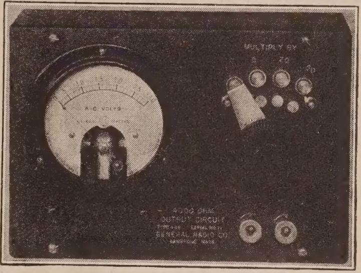


Fig. 5. Above is shown a type 486 output meter recently announced for distribution by The General Radio Co.

This resistance value is for the entire circuit. If the losses of the condenser are negligible the resistance may be considered as that of the coil, less the resistance (d. c.) of the thermo-couple and the connecting wires. After the resistance for 1500 k. c. has been determined, the same measurement may be duplicated for every 50 k. c. between 1500 and 550 k. c. and a curve of resistance versus frequency made.

Second Method

The second method of high frequency measurement, although considerably more accurate in results, the method of procedure is considerably more complicated and takes much longer to secure the results.

Tune the oscillator and test circuit to 1500 k. c. and note the deflection on the meter. Than add such an amount of resistance that the deflection is reduced by about one-quarter of that obtained when no resistance was in the circuit and note this deflection. To verify these results other values of resistance should be added and when the results are calculated, the mean average of all the readings should give a very accurate value of resistance at the frequency measured. The formulas used in this method are derived in the following manner.

As both circuits are tuned to resonance

$$I = \frac{E}{R}$$

when I is the current measured by the milliammeter with no resistance added, E the induced EMF and R the circuit resistance. When the external resistance has been added, the current will change to a new value I and as the voltage loss we assume remained the same, the new formula will be

$$I_1 = \frac{E}{R + R_1}$$

From this we see that the formula for the circuit resistance would be

$$R = \frac{R_1}{\frac{I}{I_1} - 1}$$

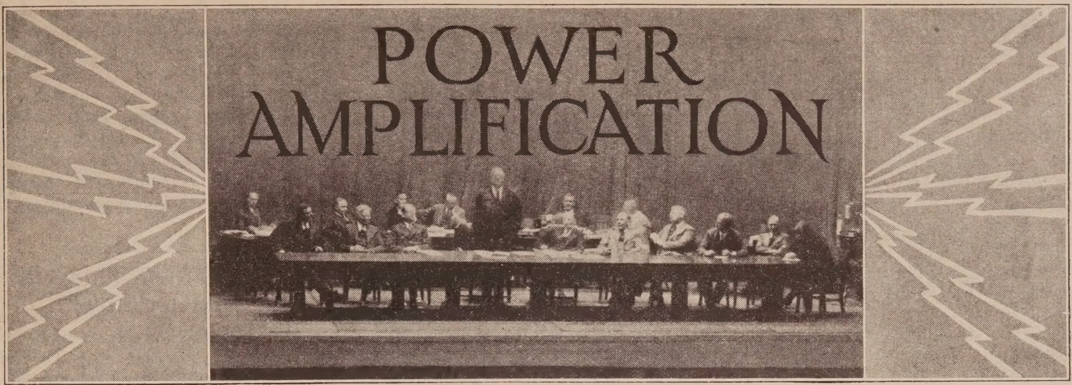
Readings at the various frequencies will give a curve similar to the one with the first method but with greater accuracy.

G. R. Output Meter

RADIO engineers will undoubtedly be interested in the recent announcement of the type 486 output meter developed by The General Radio Co. at Cambridge, Mass. The meter is illustrated in Fig. 5 on page 74 of this issue.

The type 486 output meter consists of a 4000 ohm resistor for connecting to the output of the amplifier in a radio receiver. Across this resistor is connected an alternating current voltmeter of the copper oxide rectifier type. This meter has a full scale reading of 3 volts, but multipliers may be switched to increase this range by 5, 20 and 50 times respectively, bringing the maximum voltage reading up to 150 volts. The instrument is, therefore, capable of measuring a maximum power output of 5.6 watts. It is suitable for operation through the entire audio frequency band.

POWER AMPLIFICATION



RADIO equipped apartment houses are now becoming the rage and with the installation of radio and public address systems in these dwellings, professional set builders and service men are finding abundant profit. There seems to be no limit to the size of the house that may be so equipped as will be seen by a careful reading of the descriptive matter on these pages.

One of the first installations that comes to our attention is that made by Roy Bauman of the Radio Contractors, 2029 N. Spaulding Avenue, Chicago, Illinois. This installation was placed in the Lake Lane Apartment in Chicago and has 92 outlets for speakers with a choice of two programs. In the photograph shown in Fig. 1 is the completed apartment house at the top, the master receiving sets at the left and one of the typical installations in the room at the right.

Controlled Volume

No volume control has been provided at the outlets of the 92 rooms because it is desired that volume be controlled at the master set, so as not to allow the guest to turn on enough volume to disturb people in the next room.

No. 19 twisted pair wire is used and it is run through loom conduit. The wiring is a series parallel arrangement. The receiver used is a Sparton chassis employed as a foundation unit with a Samson built to order amplifier. The Yaxley 234 outlet plates are used as well as the phone plugs made by the same concern. The speakers used in each of the rooms are the Utah magnetic cone such as the ones illustrated in the photograph in Fig. 1 at the right.

One of the interesting features in connection with the Lake Lane Apartment installation is the fact that the proprietors of the building

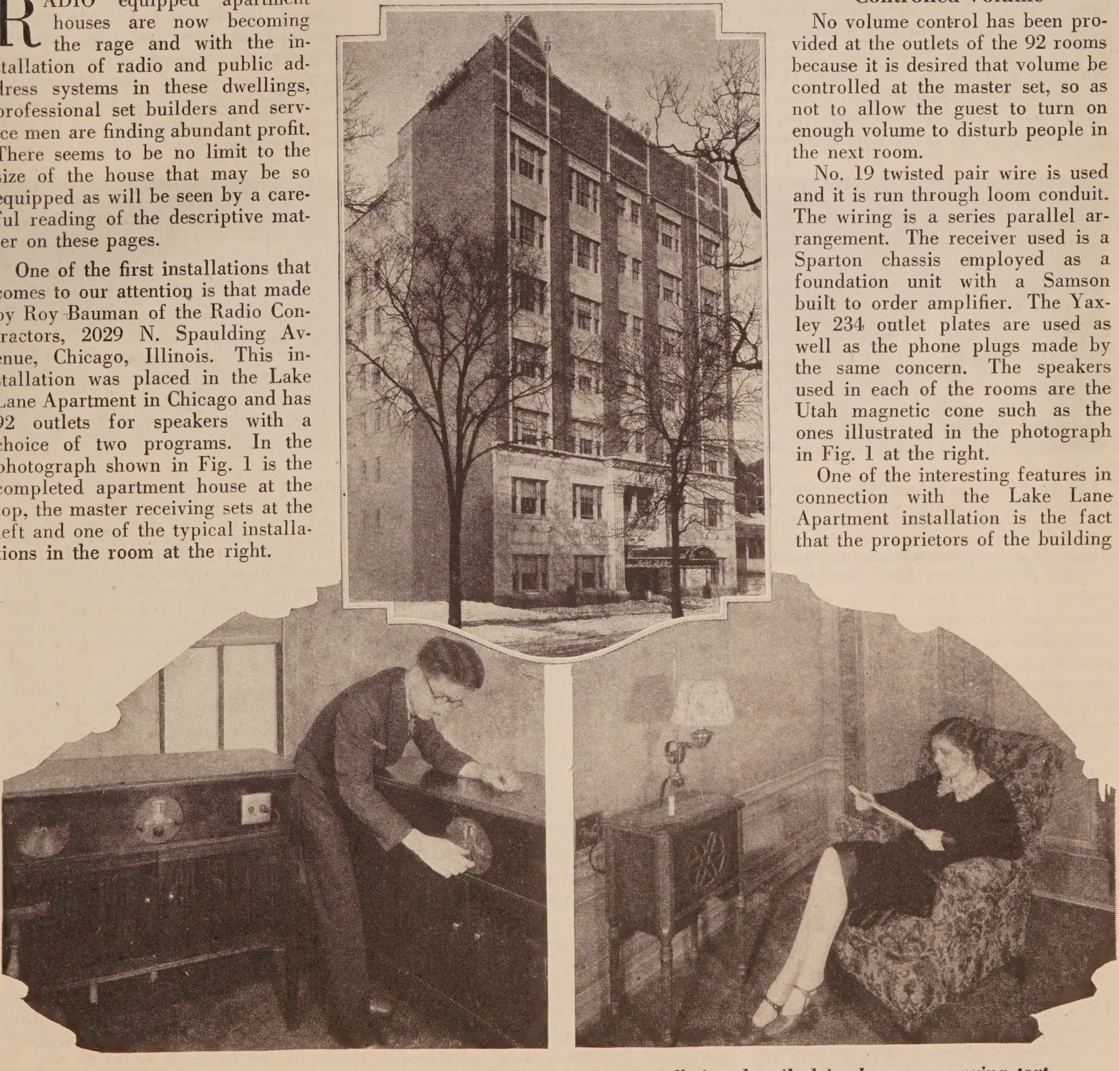


Fig. 1. This gives a composite idea of the Lake Lane Apartment installation described in the accompanying text. The upper photograph is the apartment building itself, the lower left shows the master receivers used in the radio room, while the lower right is the speaker installation in one of the 92 rooms that are so equipped in that building. The designer of the installation is shown in the lower left-hand photograph tuning one of the receivers

were enabled to rent out the entire series of rooms in a record breaking time simply because of the advertised announcement that each room was radio equipped. This announcement has served as a precedent for others in the same business as a consequence many apartment building advertisements now bear the statement "Radio Equipped" or "Radio In Every Room."

Quality Excellent

Tone quality on the reception in the rooms is excellent and is equal to that secured from a high priced a. c. receiver. The added benefit lies in the fact that the individual renting the apartment does not have to invest in a radio set. According to the designer ample selectivity is secured to permit tuning in of WLW in the afternoon through the locals, so that almost any of the medium distant stations may be tuned in and the music furnished to the guest of the apartment.

The installation in the room consists of a double outlet in the wall and when it is desired to switch from one channel to another the phone plug is merely pulled out of one outlet and placed in the other. In the photograph shown in Fig. 1, there are two master receivers being operated. One receiver is tuned into one station and the other to a different station. The guests may select either of the two stations in accordance with their desires.

Fig. 2. This is a photograph of Henry Field, owner of station KFNF, who uses a public address system as a method of keeping in constant touch with the employees scattered throughout the buildings of the Henry Field Seed Co.

Microphone and P. A. Set for Employee Contacts

ANOTHER use may be made of a public address system similar to the scheme used by Henry Field, owner of station KFNF at Shenandoah, Iowa. Here instead of it being a public address proposition, it is more of an employee address system as used by the president of the Henry Field Seed Co. According to recent information given to the Samson Electric Co., whose amplifier was used, the Henry Field Seed Co. business is very diversified and the departments are so numerous the amplifier solves a number of problems of management and direction. Special orders, general instructions and a great many other announcements about which notes were formerly written and notices printed are now speedily put into action over the loud speakers strategically placed throughout the offices, warehouses, print shop, order filling rooms, etc. In the photograph illustrated in Fig. 2, Mr. Field is shown at the KFNF microphone. However, the amplifier system microphone looks no different, as it sits on his table by his desk. It is just an arm's length and a button press distance from the ears and attention of the 400 of his employees in that building.

Dead Spots in Ballroom Cured with P. A. System

FROM the Foster Company, 17 S. 6th Street, Minneapolis, Minn., we hear of another means of using a public address system. This particular installation is a noteworthy case where radio has come to the rescue of a puzzled dance hall owner. The Marigold Ballroom is one of the largest dance floors in the west and is used exclusively for that purpose. About 1500 couples can dance on it at the same time. The acoustics in the building were bad and there were what can be termed "dead spots," or places where the music of the orchestra did not reach. The Foster Co., according to recent advices, installed a public address system made up of a Samson a. c. microphone amplifier and one of their standard PAM-17 amplifiers, together with a two-button microphone and several Western Electric speakers. This did the work most admirably and saved the owners the large expense of remodeling the building to overcome acoustic defects. It is also understood that the owners are using a speaker from the system to bring music of the orchestra out on the street for advertising purposes. This system is also used in conjunction with a radio for broadcasting sporting events for their dance patrons.

"Decibel" Latest Scientific Unit

WHEN telephone engineers get together in the future to talk about problems of transmission, the word "decibel" will figure largely in their conversation. That is the name that has just been adopted by the engineering staff of the Bell system to designate what has previously been known as the "transmission unit." It refers to the efficiency of telephone circuits. The new name was adopted after a conference between the representative of the Bell system and the International Advisory Committee on Long Distance Telephony in Europe. The actual unit decided on was the "bel," named after Dr. Alexander Graham Bell, inventor of the telephone. The bel, however, is larger than is needed in practice, so the unit one-tenth as large, and therefore called the decibel, has been adopted by the engineers.

Centralized Radio Solves City Reception Problems

THE magic wand of ingenuity has again been waved over the radio art, sweeping away the complications of antennas, ground connections, lengthy lead-ins, wholesale interference between closely packed receivers, the possession of a receiver in the house of an anti-radio landlord or the lack of a receiver in a strange city, and so on, which have in some areas constituted obstacles to the full enjoyment of present-day radio.

MARIGOLD
BALLROOM
MARIGOLD

Fig. 3. In the Marigold Ballroom in Minneapolis, there is a radio installation whereby some 1500 couples can dance to the music provided by the public address system. The installation originally was made necessary on account of bad acoustics or dead spots where the music of the orchestra could not be heard. Radio came to the rescue, as is related elsewhere in this article

Boon to Guests

The transient in the hotel, or the patient in the hospital can now enjoy radio programs without having to own a radio set. The tenant with his favorite radio set can now plug into a convenient wall plate for antenna and ground connections, assured of an efficient installation. Centralized radio, is what the new system is called, and it ushers in a new day for large-scale broadcast reception.

Centralized radio has been evolved out of the necessity of accommodating dozens and sometimes hundreds of radio listeners under one roof. In the case of the hotel or hospital, with its transient listeners-in, the problem has been one of supplying radio programs from a central radio receiver, in sufficient variety, and range of volume to meet individual needs and tastes. In the case of apartment houses and apartment hotels with their more permanent tenants, the problem has been one of suitable antenna and ground accommodations for the many receiving sets where obviously, a jungle of antennas on the roof, and lead-ins on the walls are both unsightly and inefficient.

Audio Distribution

For the transient listener-in, there has been developed some highly specialized equipment in the form of a centralized radio receiver, an efficient distribution system, and suitable outlets and sound-reproducing equipment for each room, apartment or ward. The engineering staffs of the Radio Corporation of America and its associates, the General Electric and the Westinghouse companies, have succeeded in developing equipment that ideally meets the requirements of audio centralized radio. This is not to be confused with a conventional radio receiver and amplifier, connected with scattered loudspeakers or head-phones throughout a building, for the parallel ceases after the basic principle.

The RCA audio centralized radio equipment takes the form of the necessary units mounted in standard switchboard form. One receiver, with amplifying equipment, distribution and outlet equipment, constitutes one channel. One channel is required for the reception and distribution of one program. However, more than one complete unit can be employed, and as many as four channels can be installed so that the listener-in may choose any one of four simultaneous programs.

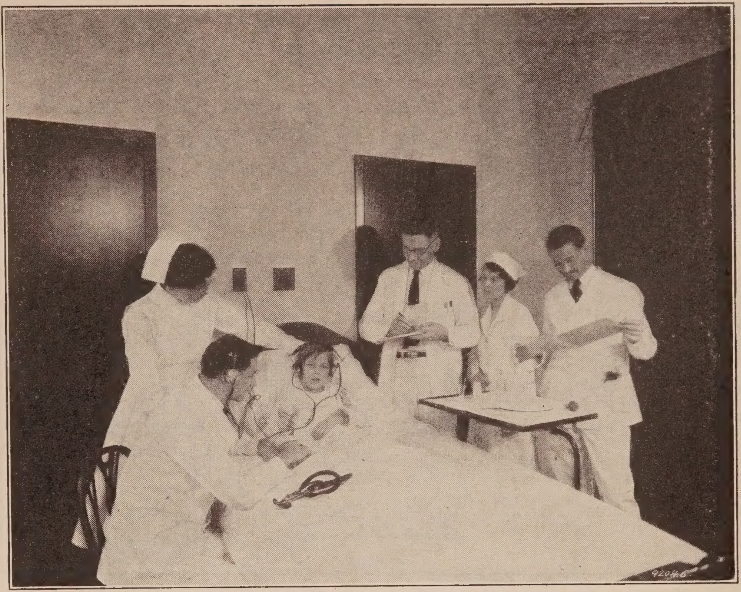


Fig. 5. Anyone who has ever tried to while away the tedium of remaining in a hospital can appreciate what a benefit radio can be to a patient. In this photograph the young patient is wearing head phones, while the doctors and nurses at the Knickerbocker Hospital in New York look on interestedly to observe the patient's reaction. This is one of the installations described in this article

A typical audio centralized radio channel installation comprises a receiver, a monitoring loudspeaker panel, one to three amplifier units depending upon the distribution system, and a control panel, all mounted on a vertical steel rack. The equipment is operated from the usual electric lighting circuit, so that no batteries are required. The receiver is of the conventional broadcast type, somewhat modified, with A-C tubes. The power amplifier comprises two 250 power tubes arranged in push-pull amplification, with an output of about 10 watts. Different volume levels may be obtained by means of different taps, so that from one up to 200 loudspeakers may be operated on a single amplifier unit, or from 2000 to 3000 head sets. If the load exceeds 10 watts, additional amplifier units may be added. The distribution circuits from each amplifier are separate electrically, so that trouble in one circuit will not affect others. A distortion indicator serves to indicate when the power amplifier is being overloaded so that the operator can correct this condition by reducing the volume.

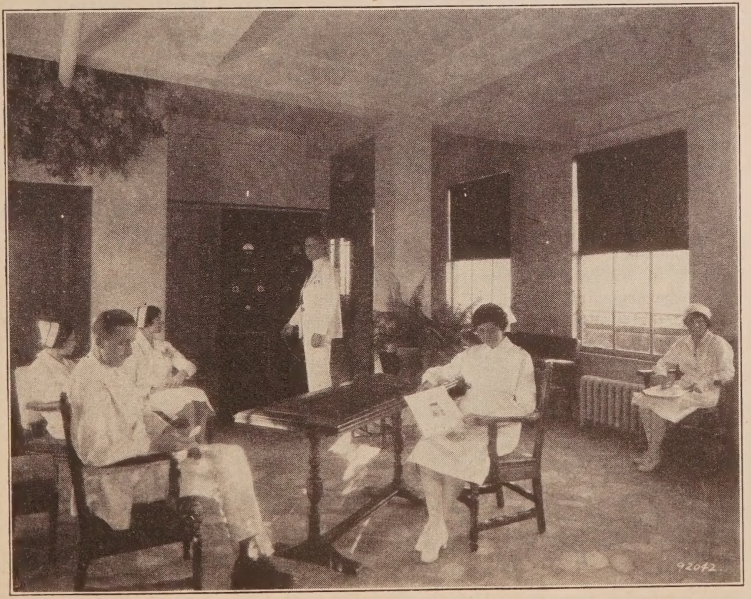


Fig. 4. One of the typical RCA centralized radio distribution systems is illustrated above. It is located in the reception room of the Knickerbocker Hospital in New York. The control panel with an attendant standing before it is seen in the background

Automatic Starting

The operation of the centralized radio receiver is reduced to the simplest terms. The receiver for each channel is tuned to a given station, and the tuning dials locked in position, to prevent tinkering. A time clock switch starts the programs at any designated hour, and turns them off at night, without attention. The centralized radio equipment may be placed in the superintendent's quarters, alongside the telephone

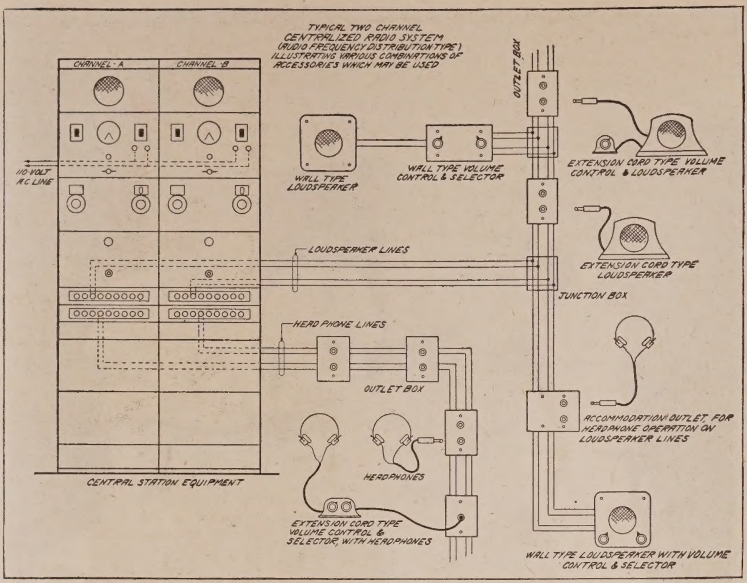

TYPICAL TWO CHANNEL
CENTRALIZED RADIO SYSTEM
(AUDIO FREQUENCY DISTRIBUTION TYPE)
ILLUSTRATING VARIOUS COMBINATIONS OF
ACCESSORIES WHICH MAY BE USED
CHANNEL · A
CHANNEL · B
110-VOLT
A.C. LINE
WALL TYPE
LOUDSPEAKER
WALL TYPE VOLUME
CONTROL & SELECTOR
OUTLET BOX
EXTENSION CORD TYPE VOLUME
CONTROL & LOUDSPEAKER
EXTENSION CORD TYPE
LOUDSPEAKER
LOUDSPEAKER LINES
JUNCTION BOX
HEAD PHONE LINES
OUTLET BOX
ACCOMMODATION OUTLET, FOR
HEADPHONE OPERATION ON
LOUDSPEAKER LINES
HEADPHONES
CENTRAL STATION EQUIPMENT
EXTENSION CORD TYPE
VOLUME CONTROL &
SELECTOR, WITH HEADPHONES
WALL TYPE LOUDSPEAKER WITH VOLUME
CONTROL & SELECTOR

Fig. 6. This drawing illustrates the electric layout of one of the two channel centralized radio systems installed in the Knickerbocker Hospital in New York

switchboard, behind the desk of the hotel, in the office of the hospital, or anywhere that space is available. Phonograph records can be played, in the absence of programs.

From the centralized radio unit, the distribution wiring leads to all parts of the building. The wiring should be of a permanent character, in shielded iron conduit, lead covering, metal moulding, or flexible conduit (BX), in accordance with best electrical practice. This wirings leads to suitable outlets. The individual installations may take various forms. One is a loudspeaker mounted flush in the wall, with volume control and selector switch for controlling volume and selection of programs. Another type is a wall-plate with jack for the plugging of loudspeaker or headphones, with or without volume control and selector switch.

The audio centralized radio system is obviously best suited to the requirements of hotels, hospitals and other institutions with transient guests, since it permits the enjoyment of radio programs without the bother of individual radio sets. Convenient as this system may be, however, it is not always acceptable to those who possess a radio set and wish to do their own radio tuning. Obviously, there is need for some centralized radio system which will bring all radio waves to the individual receivers in many apartments, to take the place of the haphazard antennas and troublesome interplay between closely packed receivers.

Multiple Receiver Aerial

In this connection, the engineering staffs of the Radio Corporation of America, and its associated companies, borrowed a page from their commercial receiving practice long followed in transoceanic and marine communication, where a single antenna, many miles long, is made to operate a number of receivers without diminution of efficiency or the introduction of interference. The principle of radio-frequency coupling between antenna and receivers has been made the foundation of a new and remarkable radio-frequency centralized radio system, which will prove a boon to progressive architects and apartment house owners.

In the RCA multiple-receiver antenna distribution system, there is no centralized radio receiver, since each listener-in is expected to furnish his own. However, there is a common antenna of ambitious proportions for utmost efficiency, which serves all the receivers in the house. The radio-frequency energy intercepted by the antenna is distributed by means of a suitable wiring system throughout the building.

Taking the place of the dozens of antennas usually strung over a city roof, one efficient antenna some 50 to 75 feet above the roof is erected. The short lead-in from the antenna is brought to a battery of central coupling units, generally located in a penthouse. From each coupling unit a line of metal conduit, enclosing the radio-frequency cable, transmits the energy picked up by the antenna, down through the building. In each apartment an extension coupling unit transfers the radio-frequency energy to the radio set, through the medium of a suitable wall outlet. Any type of radio set, requiring antenna and ground connections, may be operated. The wall plate is provided with a switch to operate the B-eliminator and coupling tube in the extension coupling unit, as well as with an outlet for the socket-power receiver.

R. F. Transmision Line

The distribution system, it will be noted, is not a mere lead-in. It is strictly a radio-frequency transmission line. The distribution system does not pick up additional signals or interference. Its length has no influence on wavelength. The tenant on the ground floor of a twelve-story apartment house enjoys the same reception as the tenant on the top floor. There is an absolute minimum of background noise, so that the reception is comparable with that of the open country. Because of the coupling units, there can be no interaction between various radio sets.

The central coupling units on the roof comprise coupling tubes and B-eliminators. There is a central coupling unit for each "riser" or transmission line. There must be an extension coupling unit, with coupling tube and B-eliminator, for each radio set. As many as ten extension coupling units may be placed on one "riser." In cases where a building is more than ten stories high, an additional transmission line or "riser" is required to meet the requirements.

Allerton House Installs Centralized Radio System

THE first major hotel installation of its new centralized radio system was announced recently by the Radio Corporation of America. To the Allerton House of Chicago, largest hotel of the Allerton chain, goes the distinction of providing individual radio reception, through a wall-type loudspeaker, to guests in 887 of its 990 rooms, and pioneering in a new field of hotel service.

Other hotels have experimented with radio service in guest rooms. Headphones, plugged into a base-board switch and movable loudspeakers connected in the same manner, have been installed in several hotels. The Allerton House, however, is the first important hotel to adopt the standard centralized equipment developed only a few months ago by the Radio Corporation's engineers.

Has Three Channels

Briefly, the present centralized radio installation comprises a central receiving unit with one, two, three or four "channels," each tuned to a different program; a powerful and highly efficient amplifying unit; and a number

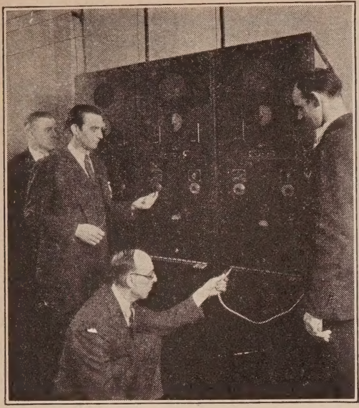


Fig. 8. Here is the three channel radio distribution system furnishing entertainment in the 887 guest rooms of the Allerton House in Chicago

of automatic controls. The entire equipment of this central receiving station, as it is called, is mounted ruggedly and compactly on a switchboard.

Secondly, there is the distribution, or "feeder" system which takes the programs to all parts of the hotel. Lastly, there is the listening-in equipment which takes the form of headphones or loudspeakers, installed in each room. The loudspeaker is equipped with a manual volume control as well as with a channel selector switch which permits the occupant of the room to enjoy a choice of programs.

Mounted on Panels

The complete equipment required for the reception of a single program constitutes what is known as a "channel," and is mounted at the back of the vertically arranged panels. Each receiving channel comprises a monitoring loudspeaker, by means of which the operator may adjust both the receiving proper and the amplifier at will.

There is also a time switch which starts and stops the programs automatically at any designated hour. Once the channel receiver has been satisfactorily tuned to a given station, its controls are locked to avoid tinkering. Separate panels are provided for both receiving and amplifying units, as well as a distribution panel for regulating the output. Additional power amplifying units may be added from time to time to compensate for any increase in the number of loudspeakers.

The manager of the Chicago Allerton House, W. W. Dwyer began to give serious consideration to radio installation early last fall. The interest which his guests displayed in the national election, sporting events and other features relayed through the air convinced him that radio should be an integral part of hotel service.

All Wanted Radio

After weeks of thoughtful consideration and discussion with his guests, Mr. Dwyer conducted a referendum, giving every room occupant an opportunity to vote on the question. The result was almost unanimous. Radio carried every floor of the 25-story hotel.

All but two floors of the hotel, 887 out of 990 rooms have been equipped, the remainder being reserved for such guests as have no interest in radio programs.

The original installation calls for three channels, making three separate programs available for each room. The equipment is such, however, that another channel may be added. The hotel may utilize one of the channels to broadcast a program of dance music or other entertainment from Victrola records.

Fig. 7. The first major hotel installation of a centralized radio system was recently completed in the Allerton House of Chicago, the largest hotel of the Allerton chain

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Wright-DeCoster Making Baffles and Horns

RECENT announcement has been made by Wright-DeCoster Inc., St. Paul, Minn., of their entry into the production of baffles and horns in addition to the new reproducer, a photograph of which is shown in Fig. 10 accompanying this article.

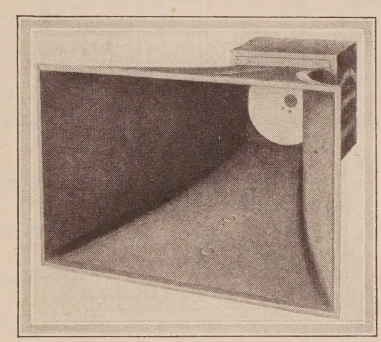


Fig. 9. Recently one of the Wright-DeCoster horns was installed in our laboratory for test purposes and is illustrated in above photograph, the dynamic speaker at the business end of the horn

Features emphasized by the new speaker include a 10-inch cone insuring greater power handling capacity and proper wave action, the apex of the cone being suspended with leather in all models. Improved design practically eliminates the damping effect of the leather at low volume. The speech coil is wound on a lathe cut bakelite form, giving full winding space, strength and uniformity with least weight. Voltage breakdown between layers of the speech coil is over 200 volts.

Field supply of the a. c. models is from a dry disc full wave high voltage rectifier whose d. c. output is fed to the field coil through a Pi section filter, this filtering, together with a bucking coil and copper shading link at the pole pieces, reduces hum practically to inaudibility.

Requests from customers of Wright-DeCoster led to their decision to make baffles and horns. Two forms of

(*Continued on page* 136)

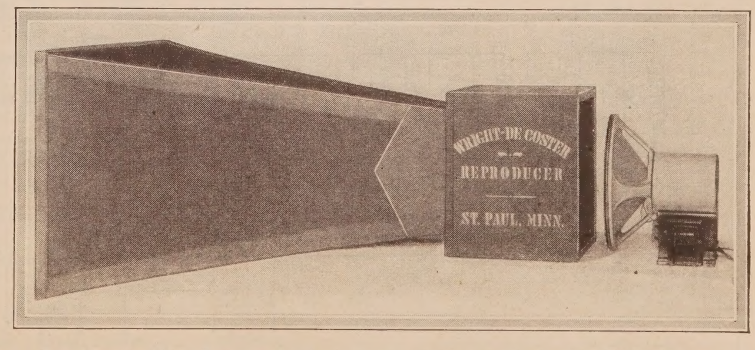


Fig. 10. In this photograph the dynamic speaker made by Wright-DeCoster is shown separately from the horn which was recently tested in our laboratory

SERVICE
and
REPAIR

The Majestic Receiver, Model No. 70

MANUFACTURED by the Grigsby-Grunow Co. of Chicago, the Majestic Model No. 70 receiver and 7P6-7P3 power pack is shown schematically on this page.

The circuit is known as the LMC circuit and is of the balanced type for use with raw a. c. tubes. Seven tubes are employed in the receiver, of which four are 226's, one is a 227. Two 171-A tubes are utilized in the push-pull power stage. The power supply uses a 280 rectifier. Input and volume control is a combination shown in the schematic diagram, Fig. 2, employing a 10,000 ohm variable resistor, which makes possible a smooth control. Instantaneous control of volume is also possible. Along with the input system is the antenna trimmer, which operates to vary the inductance of the antenna input coil and permits adjusting the input circuit to exact resonance with the other three tuned circuits.

A resistance ballast connected in series with the primaries of the transformers across the line provides a practically uniform voltage across the transformers with variations in line voltage of from 90 to 130 volts. This resistance ballast is incorporated in the power unit shown in Fig. 1.

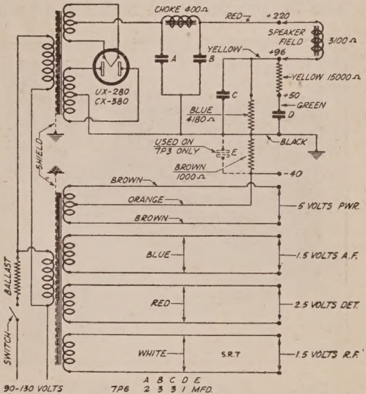

CHOKE 400Ω
RED
+220
SPEAKER FIELD
3100Ω
YELLOW
+96
A
B
UX-280
CX-380
YELLOW 15000Ω
C
+50
GREEN
D
BLUE 4180Ω
BLACK
SHIELD
USED ON 7P3 ONLY
E
BROWN 1000Ω
-40
BROWN
ORANGE
BROWN
5 VOLTS PWR.
BLUE
1.5 VOLTS A.F.
BALLAST
RED
2.5 VOLTS DET.
SWITCH
WHITE
S.R.T
1.5 VOLTS R.F.
90-130 VOLTS
30-60 CYCLES
A B C D E
7P6 2 3 3 1 MFD.
7P3 2 6 2 2 1 MFD.

Fig. 1. The schematic circuit above shows the electrical connections in the Majestic 7P6-7P3 power pack

Grid biasing is accomplished in the Majestic by grounding the grid of the amplifiers and applying a positive potential to the filament. The function of the bias resistors in the first audio stage, and the three radio stages is the same as the power tube except that the values of current and resistance are different in each case.

The Majestic receiver comprises five unit assemblies which are: The chassis, the tuning condenser, the radio frequency transformers, the terminal strip and the wiring cable.

In all there are six power units used on Majestic receivers. These power units can be identified by the following symbols: 6P3, 6P6, 7P3, 7P6, 8P3 and 8P6. This coding of the power units is very simple, as the first numeral indicates the type of receiver on which the unit is to be used, where it is 6P, 7P, 8P series receiver; and the second numeral indicates the frequency on which the power unit is intended to be used. Six is to indicate a 60 cycle unit, three is to indicate a 30 cycle.

The Majestic power speaker, which is of the electro-dynamic type, is of the best type suited to handle large volume and at the same time give good quality of reproduction. The resistance of the speaker field coil is 3100 ohms. No adjustments of any kind are required in this speaker.

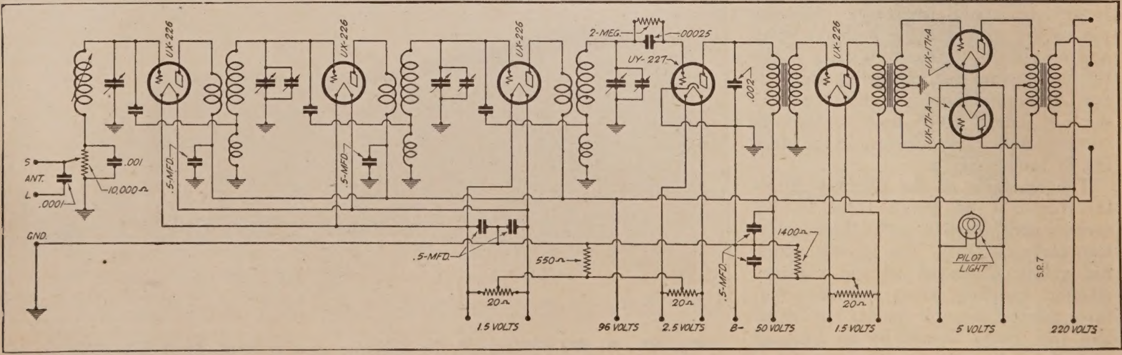

UX-226
UX-226
UX-226
2-MEG.
.00025
UY-227
.002
UX-226
UX-171-A
UX-171-A
S
ANT.
L
.0001
.001
10,000Ω
.5-MFD.
.5-MFD.
GND.
.5-MFD.
550Ω
20Ω
1400Ω
.5-MFD.
20Ω
20Ω
PILOT LIGHT
S.R.T
1.5 VOLTS
96 VOLTS
2.5 VOLTS
B-
50 VOLTS
1.5 VOLTS
5 VOLTS
220 VOLTS

Fig. 2. This diagram is the schematic involved in the Majestic Model No. 70 receiver described on this page

Kolster 4 Tube Chassis and Supply

SEVERAL models of radio receivers are made by the Kolster Radio Corp. of Newark, N. J. In this article we are giving the schematic circuit of the four tube chassis and its power pack. The Kolster six tube model consists of three stages of tuned radio frequency amplification, detector and two stages of transformer coupled audio frequency amplification, supplied with voltages suitably transformed and rectified through equipment designed and developed by Kolster engineers to operate on a. c. voltage supply.

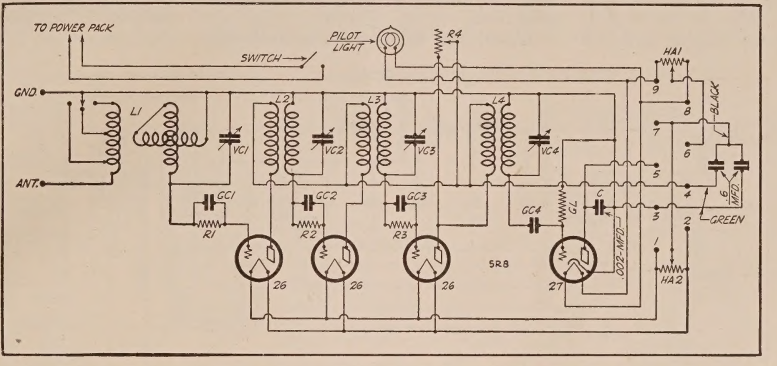

TO POWER PACK
PILOT LIGHT
R4
SWITCH
HA1
GND
ANT.
L1
L2
L3
L4
VC1
VC2
VC3
VC4
GC1
GC2
GC3
GC4
R1
R2
R3
GL
C
.002-MFD.
.6 MFD.
BLACK
GREEN
9
8
7
6
5
4
3
2
1
HA2
26
26
26
27
SR8

Fig. 1. Schematically is shown above the Kolster 4 tube chassis. The audio is included in the power pack

Set and Supply Separate

Fig. 1 shows schematically the four tube chassis, while Fig. 2 shows the power pack, in which are located the first and second audio stages in addition to the rectifier and the high voltage supply.

Volume control is by a variable resistance across the primary of the last r. f. transformer, enabling the operator to vary the gain of that particular stage. In consequence, the volume may be increased or decreased, as desired.

Antenna input is controlled by means of a switch, while there is also provided a combined variometer-variocoupler which tunes the first r. f. stage independently of the main control. This allows compensation of this stage so as to be in line with succeeding stages.

This also allows the set to be installed with any antenna or moved without affecting the position of logging on the selector scale. The r. f. coils are solenoidal in type and are wound on composition tubing. They have a very low radio frequency resistance. The coils are so placed and shielded that a minimum amount of interstage coupling results.

R. F. Grids Stabilized

Grid resistances are placed in each r. f. grid circuit to prevent oscillation. Signal rectification is accomplished by grid condenser and grid leak method with the grid leak running from grid to ground.

The audio transformers were especially designed by Kolster engineers to match the average tube in impedance. They were designed for compactness, minimum climatic reaction and ease in servicing. They are sealed in a grounded metal housing. The transformers have a comparatively flat characteristic curve, resulting in a relatively even amplification of all sound frequencies.

At the right of the diagram shown in Fig. 2, are two small schematics of the filter condensers used with the power supply, one being for the 25 cycle job and the other for the 60 cycle.

Three 226 tubes are used in the r. f. stages, while the detector is a 227 heater type. The first audio is also a 226 and the last stage tube is a 171-A. The rectifier tube is a 280 and is located in the power supply and amplifier unit.

Filament voltages are a. c. and cannot be varied from the controls of the set. The power pack is so designed to supply voltages specified by the tube manufacturers under normal a. c. line conditions. There is a voltage regulator switch incorporated in the power pack.

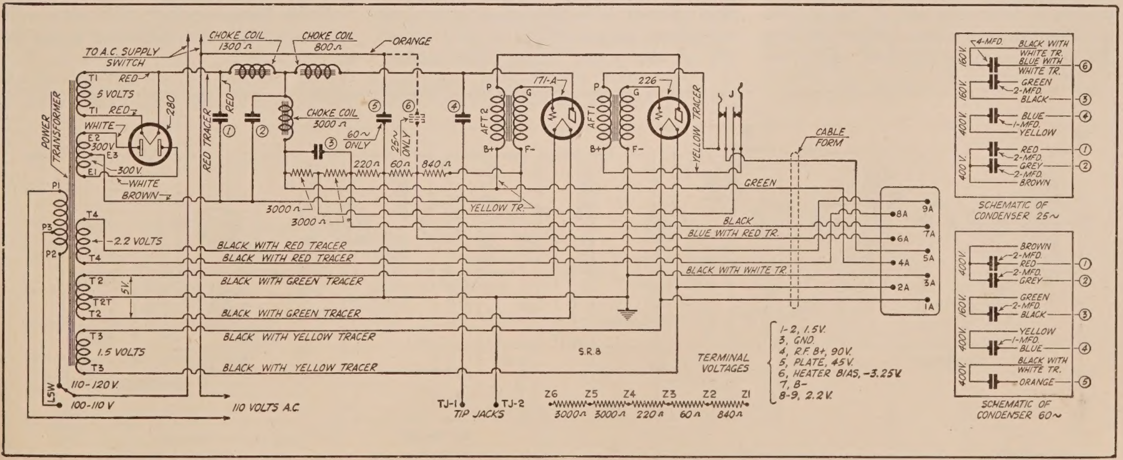

TO A.C. SUPPLY SWITCH
CHOKE COIL 1300 Ω
CHOKE COIL 800 Ω
ORANGE
POWER TRANSFORMER
T1
RED
5 VOLTS
T1
RED
280
WHITE
E2
300V.
E3
E1
300V.
WHITE
BROWN
P1
P3
P2
T4
2.2 VOLTS
T4
T2
5V.
T2T
T2
T3
1.5 VOLTS
T3
LSW
110-120V.
100-110 V
110 VOLTS A.C.
RED TRACER
RED
①
②
CHOKE COIL 3000 Ω
③
60~ ONLY
⑤
⑥
25~ ONLY
④
220 Ω
60 Ω
840 Ω
3000 Ω
3000 Ω
BLACK WITH RED TRACER
BLACK WITH RED TRACER
BLACK WITH GREEN TRACER
BLACK WITH GREEN TRACER
BLACK WITH YELLOW TRACER
BLACK WITH YELLOW TRACER
YELLOW TR.
AFT 2
P
G
B+
F-
171-A
AFT 1
P
G
B+
F-
226
YELLOW TRACER
J
CABLE FORM
GREEN
BLACK
BLUE WITH RED TR.
BLACK WITH WHITE TR.
9A
8A
7A
6A
5A
4A
3A
2A
1A
S.R.8
TJ-1
TJ-2
TIP JACKS
Z6
Z5
Z4
Z3
Z2
Z1
3000 Ω
3000 Ω
220 Ω
60 Ω
840 Ω
TERMINAL VOLTAGES
1-2, 1.5V.
3, GND.
4, R.F. B+, 90V.
5, PLATE, 45V.
6, HEATER BIAS, -3.25V.
7, B-
8-9, 2.2V.
4-MFD.
160V.
BLACK WITH WHITE TR.
BLUE WITH WHITE TR.
⑥
160V.
GREEN
2-MFD.
BLACK
③
400V.
BLUE
1-MFD.
YELLOW
④
400V.
RED
2-MFD.
GREY
2-MFD.
BROWN
①
②
SCHEMATIC OF CONDENSER 25~
400V.
BROWN
2-MFD.
RED
2-MFD.
GREY
①
②
160V.
GREEN
2-MFD.
BLACK
③
400V.
YELLOW
1-MFD.
BLUE
④
400V.
BLACK WITH WHITE TR.
ORANGE
⑤
SCHEMATIC OF CONDENSER 60~

Fig. 2. Aside from the high voltage supplied, the Kolster power pack also contains the two audio stages

Sparton A. C. 89 Receiver and Pack

KNOWN as the Equasonne circuit, the receiver whose schematic diagrams are shown in the article, is manufactured by the Sparks-Withington Co. at Jackson, Michigan. The particular model diagrammed herewith is called the Sparton model A. C. 89.

Uses 250 Tube

Referring to the receiver's schematic shown in Fig. 2, it will be found that six tubes are used in the receiver proper, these being of the heater type, such as the 227. The power tube is contained in the power supply and is a type 250. The rectifier used is the conventional 280.

Signal Is Pretuned

There are several features of this receiver which are different from the general run of sets with which the service man is familiar. For example: At the left in the schematic, Fig. 2, it will be observed that there is a set of inductances and tuning capacities linked together inductively and all lying between the antenna circuit and the grid of the first radio frequency tube. This is known as the selector system and is used exclusively by the Sparton interests in the various models of their receiver. A signal from the antenna is pretuned before reaching the grid circuit of the first radio frequency tube. From then on towards the detector the signal is amplified through the succeeding radio frequency stages but is not further tuned.

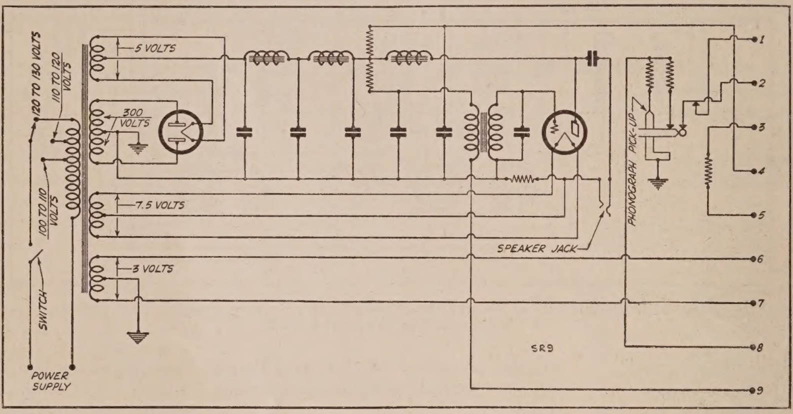


Fig. 1. Here is shown schematically the power pack used with the Sparton A. C. 89 receiver

Aperiodic Amplification

It will be observed that the r. f. coil diagrams in this circuit are not of the conventional type, since these coils function aperiodically to amplify whatever frequency is fed into the receiver by the pretuning arrangement. In the detector stage, rectification is by means of the grid bias.

It will also be observed by following the schematic of the power supply and the amplifier shown in Fig. 1 that only one stage of audio is used, a 250 tube being employed for this purpose. The transformer for the grid circuit of that tube is included in the power supply. The speaker is located through a large condenser across the plate and center tap of the power stage. The rectifier used in the power supply is the 280 type, full wave. Arrangements are also made for a phonograph pick-up that may be used in connection with the receiver.

In the schematic circuit in Fig. 2 it will be seen that the antenna circuit goes through a variable condenser before reaching the selector unit. When the receiver is installed by the dealer or service man, it is necessary that the adjusting screw of this condenser be turned back and forth until maximum volume is secured. If the customer changes aerials it will be necessary to make a readjustment on the antenna compensating condenser.

Voltage Measurements

In making measurements on the receiver, all tests should be made with the volume control full on and the voltage adjuster on the proper tap. Detector plate voltage will normally be 188 volts, without phonograph pick-up and jack and 115 with the pick-up. The limits of variation are 150 volts to 250 volts without pick-up, and 90 to 140 volts with pick-up. More or less than this indicates a defective plate circuit.

Radio frequency amplifier plate voltages are 112 volts, with the limits being 90 to 135.

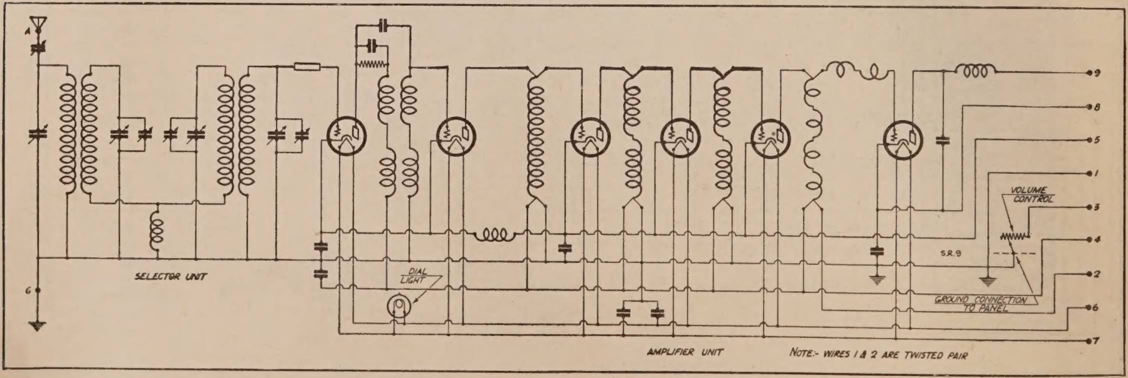
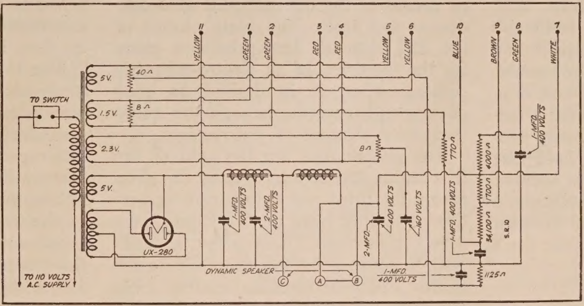


Fig. 2. Shown at the left in this schematic of the Sparton A. C. 89 is the selector system ahead of the first r. f. tube

Bremer-Tully Model 7-70 and Supply

ONE of the models made by the Bremer-Tully Mfg. Co. of Chicago is known as the 7-70, the schematic circuit for which is shown on this page. In addition there is also shown the electrical circuit of the power converter for this model.

The receiver employs three 226 tubes, these being in the three radio frequency stages; two 227 tubes, one in the detector and the other in the first audio; and two 171-A tubes arranged in push-pull for the power output circuit. The schematic diagram of the receiver itself is shown in Fig. 2. The power converter utilizes a single 280 full wave rectifier and the schematic circuit covering this unit is shown in Fig. 1.



11
1
2
3
4
5
6
10
9
8
7
YELLOW
GREEN
GREEN
RED
RED
YELLOW
YELLOW
BLUE
BROWN
GREEN
WHITE
5V.
40Ω
TO SWITCH
1.5V.
8Ω
2.3V.
8Ω
5V.
1-MFD. 400 VOLTS
2-MFD. 400 VOLTS
2-MFD.
400 VOLTS
160 VOLTS
770Ω
4000Ω
1-MFD. 400 VOLTS
1700Ω
34,100Ω
S.R.10
1-MFD. 400 VOLTS
UX-280
TO 110 VOLTS A.C. SUPPLY
DYNAMIC SPEAKER
C
A
B
1-MFD. 400 VOLTS
1125Ω

Fig. 1. Shown schematically above is the Bremer-Tully power converter for their 7-70 model

Neutralized R. F. Stages

It will be seen by referring to Fig. 2 that the three radio frequency stages are neutralized by means of small neutralizing condensers and a neutralizing winding included in the plate circuit of the tube and a neutralizing tap in the grid circuit of the same tube. The antenna stage condenser has a trimmer by means of which this particular stage may be balanced to take care of varying antenna conditions. The tuning condensers across the second and third r. f. stages do not have the trimming arrangement, although the detector circuit tuning condenser does have a trimmer.

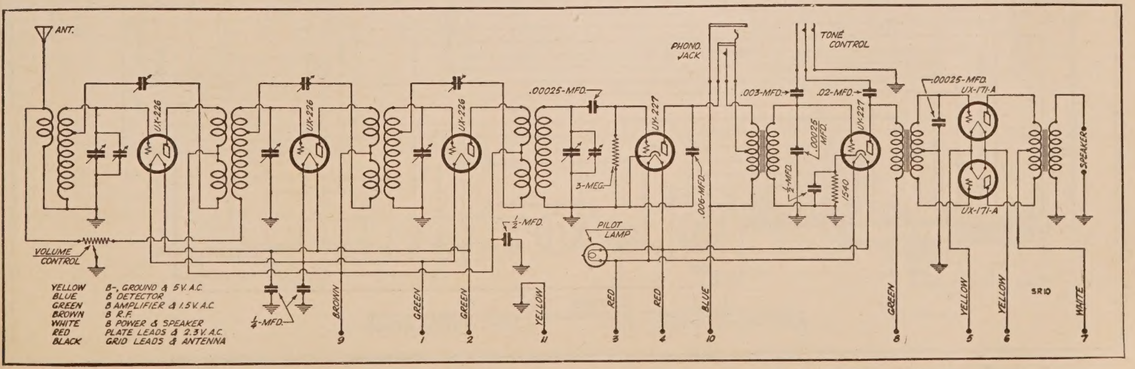
Volume control is secured by means of the potentiometer located between one end of the antenna coil and the grid return portion of the secondary of the second r. f. inductance, the arm of the volume control being grounded. This volume control in one position acts as a short circuit upon the antenna circuit. In the opposite position it places a high resistance from the antenna to ground.

The tone control shown in the schematic is a three leaf switch, with an "on" and "off" position. In the "on" position, it serves to tune simultaneously the grid and plate circuit of the 227 first audio tube, in the case of the grid circuit it serves to add to the existing .00025 mfd fixed condenser between grid and ground and an additional .003 mfd fixed condenser and at the same time places a .02 mfd fixed condenser between plate and grid. When the switch is in the "off" position, the only condenser across the grid circuit of the first audio is the .00025 mfd previously mentioned. C bias for the first audio stage is secured by the drop across a 1540 ohm resistor bypassed with a ½ mfd condenser between cathode of the tube and ground.

Phonograph Pickup

A phonograph pick-up jack is provided on the receiver being placed in the primary of the first audio transformer but at a tapped position, so that more amplification is provided by that particular transformer when used with the magnetic pick-up than is provided by the plate circuit of the detector. In the push-pull input side of the 171 tubes a .00025 mfd fixed condenser is placed from the center tap to one grid of the power tube as a means of preventing oscillation or unbalance.

The power supply schematic is shown in Fig. 1, where it will be seen to consist of 110 volt primary with high voltage secondary, a 5 volt secondary for the filament of the 280, a 5 volt secondary for the 171-A filaments, a 1.5 volt secondary for the 226 tubes and a 2.3 volt secondary for the heaters of the 227's. The resistance network is a combination of 4000 ohms resistance for the plate of the first audio, 1700 ohms for the 3 r. f. plates and 34,100 ohms for the detector plate. This method of connection eliminates the bleeder current in the resistances and lessens the tendency of any receiver to motor-boat. The terminals A and B are shorted in the diagram and when a dynamic speaker with a high voltage a. c. field is employed, it is inserted between terminals C and B, the field winding of the dynamic taking the place of the second portion of the filter choke. Center tap across the 5 volt winding for the 171-A's is secured by a 40 ohm center tapped resistance, while the drop across the 1125 ohm resistor between this center tap and the common B negative and ground lead supplies bias for the grids of these two tubes in push-pull. The bias for the r. f. stages is secured through the drop across a 770 ohm resistor between the center of the 8 ohm center tapping resistor across the 1.5 volt filament line and the center B negative and ground terminal. A 227 is used as the first audio.



ANT.
UX-226
UX-226
UX-226
.00025-MFD.
UX-227
3-MEG.
½-MFD.
PILOT LAMP
.006-MFD.
PHONO. JACK
TONE CONTROL
.003-MFD.
.02-MFD.
.00025 MFD.
½-MFD.
1540
UX-227
.00025-MFD.
UX-171-A
UX-171-A
SPEAKER
VOLUME CONTROL
YELLOW B-, GROUND & 5V. A.C.
BLUE B DETECTOR
GREEN B AMPLIFIER & 1.5V. A.C.
BROWN B R.F.
WHITE B POWER & SPEAKER
RED PLATE LEADS & 2.3V. A.C.
BLACK GRID LEADS & ANTENNA
½-MFD.
BROWN
GREEN
GREEN
YELLOW
RED
RED
BLUE
GREEN
YELLOW
YELLOW
SR10
WHITE
9
1
2
11
3
4
10
8
5
6
7

Fig. 2. This diagram shows the electrical circuit of the Bremer-Tully 7-70 model

Day-Fan 5080 Receiver and Supply

USING eight tubes and a rectifier, the Day-Fan model 5080 receiver, manufactured by the Day-Fan Electric Co. of Dayton, Ohio, is described herewith.

Has Push-Pull Audio

The receiver consists of three stages of tuned radio frequency amplification preceded by an aperiodic antenna stage and followed by a non-regenerative detector, first stage audio and a second power stage employing two 17 1-A's in push-pull. Five 226 tubes are used in the radio frequency and first audio stages. The heater type of tube, 227, is used in the detector stage, while the 171-A's are placed in push-pull for maximum power output. The model 5080 is for use with the 110 volt d. c. dynamic speaker field winding, a receptacle on the power supply being provided into which the speaker field line may be plugged. The dynamic speaker receptacle is illustrated in the schematic diagram, Fig. 1, and is located between the right side of the filter and the filter system.

Untuned Antenna

The antenna stage of the receiver consists of an inductance in series with the resistance lying between the antenna and ground. This inductance and resistance are spanned by a variable resistance, the movable arm of which goes directly to the grid of the first 226 tube. This tube is neutralized through a neutralizing condenser and the neutralization winding, which is shown as occupying the middle position of the three inductances between tubes. This first stage is not tuned and acts as a buffer between the subsequent tuned stages of radio frequency and the antenna itself. The second and fourth 226 tubes are tuned with variable condensers and each stage is neutralized from the grid of the tube through a small variable condenser and into the neutralizing winding of each coil.

Pickup for Records

Rectification in the detector circuit is by means of the conventional grid condenser and leak. The plate circuit of the 227 detector has provision made for the inclusion of an electro-magnetic pick-up when it is desired to play phonograph records through the audio frequency channel of the receiver.

The proper bias for the grid of the first audio 226 is provided by the drop across the third and fourth resistor sections (reading from the left), while the bias for the two 171-A tubes in push-pull is secured by the drop across the fourth and fifth resistors reading from the left. A stabilizing condenser is placed from the grid of the 226 first audio to the common negative and ground. The same procedure is adopted in the push-pull stage, where a fixed resistance spans the two extremities of the push-pull input transformer.

Output Transformer

The plate circuit of the 171-A push-pull tubes are connected to the push-pull output transformer with two fixed condensers being placed across the extremities of the primary and the common center being attached to the center tap of that winding, which is the high voltage lead of the power system. The speaker is placed across the terminals of the secondary or output winding of this same transformer.

The center tap for the filament circuit energizing the 226 tubes is secured by a resistance across the 1½ volt line. On account of the detector being of the heater type, there is no necessity for a resistance across the 2.2 volt line.

Electrostatic Shield

The 110 volt primary has an electrostatic shield which is made common with ground. It has four low voltage secondaries and one high voltage, the latter going to the two anodes of the 280 rectifier. The first secondary at the left in the diagram, Fig. 1, handles all of the 226 tubes, the second secondary is 2.5 volts for the 227 tube, while the third secondary is a 5-volt one for the 171-A filament, the fourth secondary energizes the filament of the 280 tube at 5 volts.

In this particular model, filtering is accomplished by one filter choke already in the power supply and the added filtering effect of the dynamic speaker field winding. A receptacle for this has been provided and is illustrated in the diagram as the two contacts within a circle.

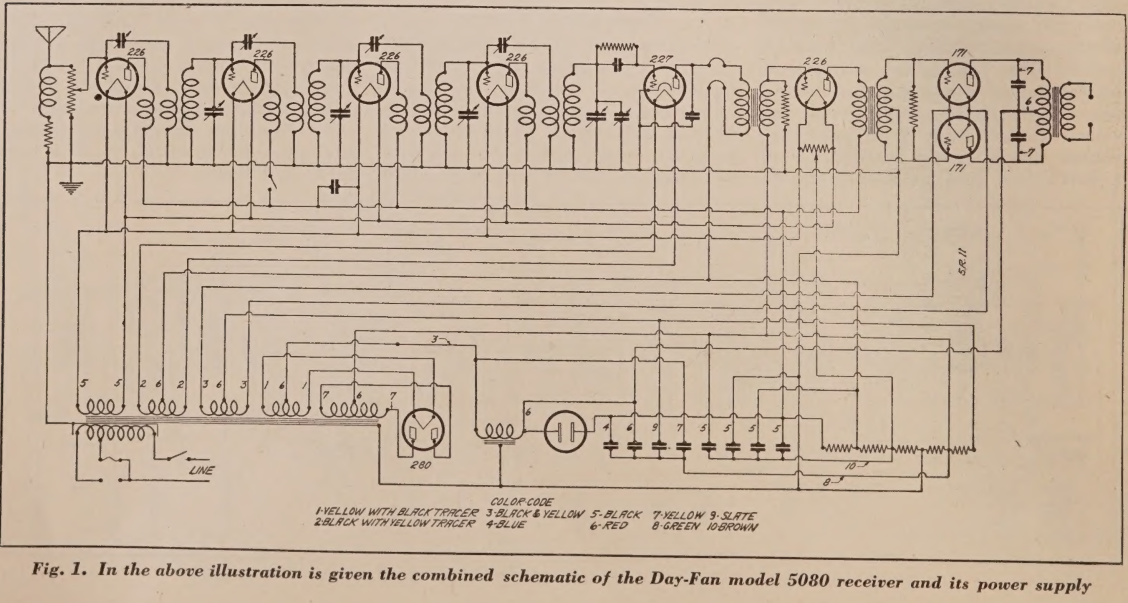


Fig. 1. In the above illustration is given the combined schematic of the Day-Fan model 5080 receiver and its power supply

Balkeit Model A Receiver and Pack

DESCRIBED on this page is the Balkeit Model A receiver manufactured by the Balkeit Radio Co., North Chicago, Illinois. It is a seven tube single dial neutrodyne receiver of the antenna type, having four tuned stages including three stages of neutralized radio frequency amplification, a tuned detector, one stage of straight and one stage of push-pull audio frequency amplification. It is equipped with a dynamic speaker field supply and may be used in connection with an electric phonograph pick-up to reproduce phonograph music.

Indoor or Outdoor Antenna

This receiver is entirely self-contained and employs five 227 heater type tubes, two 112-A tubes and a 280 rectifier. Either indoor or outdoor antenna may be used, although if an outdoor aerial is desired it should not exceed 50 feet in length and should be carefully erected and insulated. According to the schematic shown in Fig. 1, there is a hum control provided on the receiver, which is placed across the filament supply for the 227 tubes. This control is mounted near the tubes on the left-hand side of the receiver and has a shaft head arranged for adjustment with a screw-driver. In the event that objectional hum is heard, turn the volume control to the right, adjust the station selector so no signal is received and turn the hum control until a minimum hum is heard in the speaker. There will be two positions of this hum control at which hum would be at maximum intensity and the proper position will be about midway between these two positions. Ordinarily it will not be necessary to change this adjustment unless a new detector tube is used.

This receiver is designed to supply d. c. power to energize the field of any standard dynamic speaker of the type using 100 to 150 volts d. c. Dynamic speakers designed for use on 6 volts d. c. supply cannot be connected to the field terminals of the receiver. A pick-up jack located on top of the receiver chassis near the left-hand edge is provided for plugging in the cord from an electric phonograph pick-up device when it is desired to use the audio amplifying system of the receiver and the loud speaker to reproduce phonograph music. To use this feature no receiver adjustments are necessary.

Neutralization Data

The neutralizing condensers are shown in the schematic in Fig. 1 and are placed between the grid of one r. f. tube and the neutralizing tap on the secondary of the succeeding inductance. Although the set is neutralized in the beginning, if it becomes necessary to neutralize the set again, the following information may be of help. A full set of good tubes is required. In addition a single 227 tube which has a burned out heater element is used for making the neutralization test. Place all tubes in proper sockets, connect aerial, ground and speaker and tune in a strong nearby station on the lowest wavelength possible. Adjust receiver so signal is received at maximum volume. Place tube with defective heater element in first r. f. socket. If no signal is heard, this stage is properly neutralized. If a signal is heard, even though of decreased volume, the neutralizing condenser with that tube, which has its adjusting screw located directly in front of the tube, must be adjusted. Use a neutralizing tool (not a screw-driver) and carefully adjust the screw until minimum signal is heard, at the same time moving the tuning dial slowly back and forth across the station signal. Do not press on the tool when making this adjustment, as the capacity may change when the tool is removed. Remove tube with the defective heater and place a good tube in the first r. f. socket. Remove tube from second r. f. socket, place defective tube in socket and repeat as before until all stages have been neutralized.

Trimming Condenser

A fourth condenser which is known as a padding or trimming condenser is located directly in front of the detector tube. To adjust this tune in a low wavelength local station at moderate volume, adjust the tuning drum so maximum signal intensity is obtained with lowest possible setting of volume control. Use neutralizing tool and adjust padding condenser until maximum signal intensity is obtained.

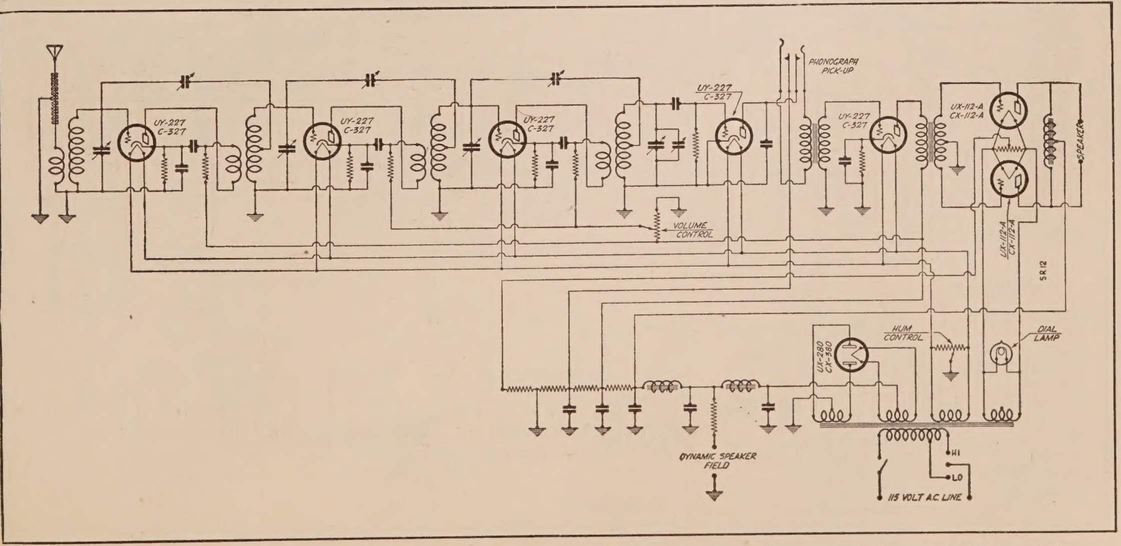


Fig. 1. Both the receiver and power supply schematics are combined in the above diagram of the Balkeit Model A Set

Fada 7 A C Model and Type C Unit

MADE by the F. A. D. Andrea, Inc., Long Island City, New York, the Fada 7 A C model is described in the accompanying text. It is illustrated schematically in Fig. 2, while its power supply, the type C unit, is shown in Fig. 1.

Permitting use of a loop as the energy collector, the receiver employs six tubes of the 227 heater type and a 171 power tube. Four of the 227 tubes are used in the tuned radio frequency stages which are neutralized, while the fifth 227 is the tuned detector stage. The first audio stage uses the remaining 227.

Shielded and Neutralized

It will be observed by referring to the schematic in Fig. 2 that all of the radio frequency stages are thoroughly neutralized and completely shielded. Type numbers of the different constituent parts of the receiver are shown in the diagram. The receiver may be either operated from an antenna and ground connection or from the loop, which is shown in the schematic diagram. The loop is plugged into the circuit when desired or it may be shorted out. One of the departures from receiver practice may be seen in the schematic, where it is found that r. f. chokes are employed in series with the cathode of all of the r. f. stages. Each r. f. choke is bypassed to chassis, while the plate circuit inductance of each stage is likewise bypassed with another condenser, these two being contained in a block known as the 1418 MS. These blocks are located within the stage itself. The plate circuit of the detector stage is also provided with an r. f. choke and its accompanying bypass condenser.

Volume control is by means of the 1430 MS resistance placed across the secondary of the second radio frequency transformer. In the power stage where the 171-A is used, the speaker is located across an output impedance, thus isolating the speaker windings from any d. c. components.

Power Unit Separate

The schematic circuit of the power supply is shown in Fig. 1 at the lower half, while an actual drawing of the wiring is shown in the upper half. A 280 tube is used as the rectifier, whose high voltage output is fed to a double choke and filter condenser arrangement. Suitable voltages for the operation of the set are brought out from taps across the resistance network, these voltages being numbered from one to ten inclusive. A table of cable connections is given in this same diagram.

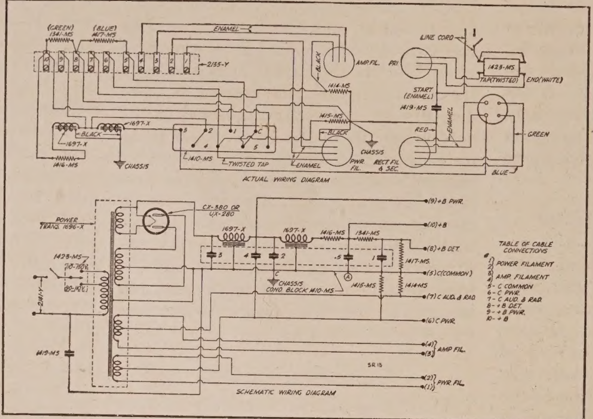
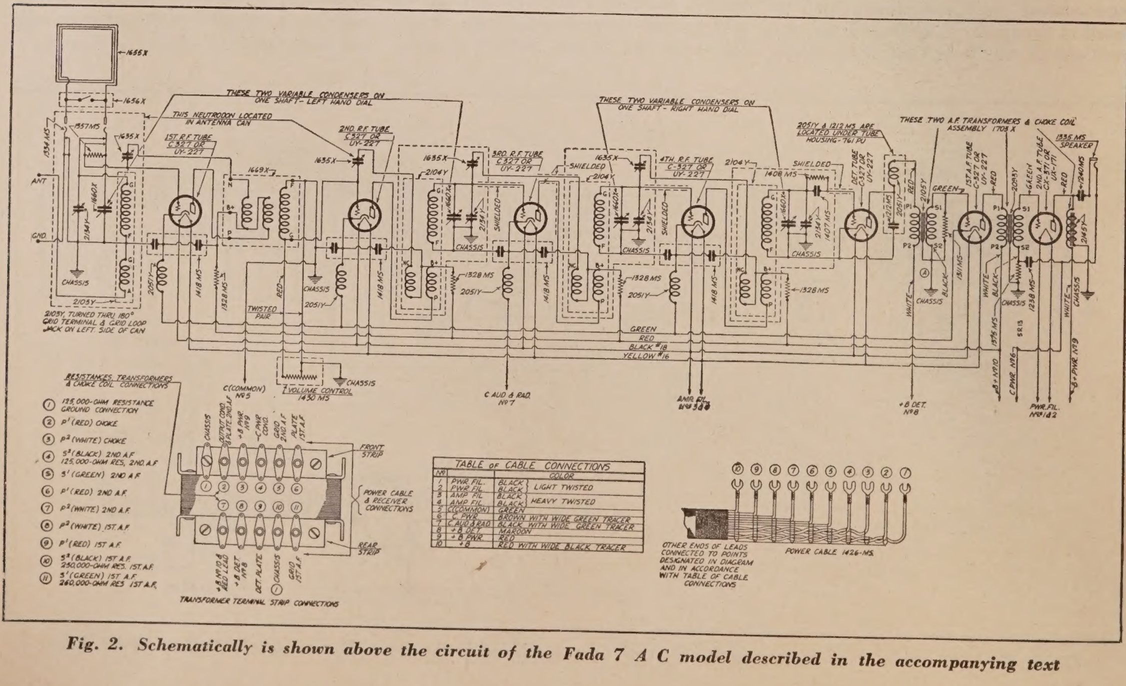

(GREEN) 1341-MS
(BLUE) 1417-MS
ENAMEL
2135-Y
LINE CORD
AMP. FIL.
PRI
1423-MS
TAP (TWISTED)
END (WHITE)
START (ENAMEL)
1419-MS
1414-MS
1415-MS
BLACK
RED
GREEN
ENAMEL
1697-X
CHASSIS
1416-MS
1410-MS
TWISTED TAP
PWR. FIL.
RECT. FIL. & SEC.
BLUE
ACTUAL WIRING DIAGRAM
CX-380 OR UX-280
POWER TRANS. 1696-X
1423-MS
1417-MS
(9) +B PWR.
(10) +B
(8) +B DET.
(5) C (COMMON)
(7) C AUD. & RAD.
(6) C PWR.
(4) (3) AMP. FIL.
(2) (1) PWR. FIL.
CHASSIS COND. BLOCK 1410-MS
1415-MS
1414-MS
1419-MS
SR 13
SCHEMATIC WIRING DIAGRAM

TABLE OF CABLE CONNECTIONS

1} 2} POWER FILAMENT
3} 4} AMP. FILAMENT
5 - C COMMON
6 - C PWR.
7 - C AUD. & RAD.
8 - +B DET.
9 - +B PWR.
10 - +B

Fig. 1. Here is shown the electrical connections of the Fada type C unit which is the receiver supply


1655X
1656X
THESE TWO VARIABLE CONDENSERS ON ONE SHAFT - LEFT HAND DIAL
THIS NEUTRODON LOCATED IN ANTENNA CAN
1ST R.F. TUBE C-327 OR UY-227
2ND R.F. TUBE C-327 OR UY-227
3RD R.F. TUBE C-327 OR UY-227
4TH R.F. TUBE C-327 OR UY-227
THESE TWO VARIABLE CONDENSERS ON ONE SHAFT - RIGHT HAND DIAL
2051Y & 1212 MS ARE LOCATED UNDER TUBE HOUSING - 761 PU
THESE TWO A.F. TRANSFORMERS & CHOKE COIL ASSEMBLY 1703 X
1336 MS SPEAKER
DET. TUBE C-327 OR UY-227
1ST A.F. TUBE C-327 OR UY-227
2ND A.F. TUBE CX-371 OR UX-171
ANT
GND
CHASSIS
SHIELDED
1669X
1635X
2104Y
1418 MS
1328 MS
2051Y
1408 MS
TWISTED PAIR
GREEN
RED
BLACK #18
YELLOW #16
2103Y, TURNED THRU 180° GRID TERMINAL & GRID LOOP JACK ON LEFT SIDE OF CAN
VOLUME CONTROL 1430 MS
C (COMMON) Nº5
C AUD. & RAD. Nº7
AMP. FIL. Nº3&4
+B DET. Nº8
+B PWR. Nº9
C PWR. Nº6
+B Nº10
PWR. FIL. Nº1&2
SR13
FRONT STRIP
REAR STRIP
POWER CABLE & RECEIVER CONNECTIONS
TRANSFORMER TERMINAL STRIP CONNECTIONS
POWER CABLE 1426-MS
OTHER ENDS OF LEADS CONNECTED TO POINTS DESIGNATED IN DIAGRAM AND IN ACCORDANCE WITH TABLE OF CABLE CONNECTIONS

RESISTANCES, TRANSFORMERS & CHOKE COIL CONNECTIONS

① 125,000-OHM RESISTANCE GROUND CONNECTION
② P¹ (RED) CHOKE
③ P² (WHITE) CHOKE
④ S² (BLACK) 2ND A.F. 125,000-OHM RES, 2ND A.F.
⑤ S¹ (GREEN) 2ND A.F.
⑥ P¹ (RED) 2ND A.F.
⑦ P² (WHITE) 2ND A.F.
⑧ P² (WHITE) 1ST A.F.
⑨ P¹ (RED) 1ST A.F.
⑩ S² (BLACK) 1ST A.F. 250,000-OHM RES. 1ST A.F.
⑪ S¹ (GREEN) 1ST A.F. 260,000-OHM RES 1ST A.F.

TABLE OF CABLE CONNECTIONS

Nº		COLOR	
1	PWR. FIL.	BLACK	LIGHT TWISTED
2	PWR. FIL.	BLACK	
3	AMP. FIL.	BLACK	HEAVY TWISTED
4	AMP. FIL.	BLACK	
5	C (COMMON)	GREEN	
6	C. PWR.	BROWN WITH WIDE GREEN TRACER	
7	C. AUD. & RAD.	BLACK WITH WIDE GREEN TRACER	
8	+B DET.	MAROON	
9	+B PWR.	RED	
10	+B	RED WITH WIDE BLACK TRACER	

Fig. 2. Schematically is shown above the circuit of the Fada 7 A C model described in the accompanying text

Freshman 2-N-12 and Power Unit

THE model 2-N-12 Freshman receiver made by the Chas. Freshman Co., Inc., and described on this page is an a. c. model operating from any ordinary electric light socket, supplying between 100 and 125 volts of from 50 to 60 cycles.

The receiver is of the uni-control type with three stages of radio frequency amplification, detector and two stages of audio frequency, employing the Freshman Equaphase system of stabilization. The chassis and power supply are combined into one unit and is located in the upper section of the console with the dynamic speaker below it.

250 Power Tube

This model uses a 250 in the last stage of the audio amplifier. In order to take full advantage of the characteristics of this tube a dynamic speaker must be used. The dynamic speaker field is included as a portion of the resistance network as will be shown by an examination of the schematic shown in Fig. 1.

The power supply system is illustrated at the lower part of Fig. 1 and consists of a 281 rectifier with the typical choke and filter circuit for smoothing out the pulsations in the rectified a. c. A novel switching arrangement is shown at the center of the diagram, where a 3 ampere fuse is located and by proper switching it may be placed either in the 120 volt line or the 110 volt line, depending upon the condition of the supply line where the receiver is being operated.

This model may also be used to electrically reproduce phonograph records. The two tip jacks (not shown in the schematic) are located at the left front of the receiver and into these the two connections from the pick-up device are placed. In this particular case the receiver should be turned on with the volume control at minimum value and the tuning control at 100 degrees or any other point where no radio stations will be received. Otherwise this would interfere with phonograph reproduction. In order to alter the volume on the phonograph method of reproduction, it is necessary for the volume control accompanying the pick-up to be employed rather than the volume control on the receiver.

Checking for Trouble

Numerous investigations by the Freshman Co. and other large radio manufacturers have conclusively demonstrated that the actual amount of trouble occurring in a radio set itself is small in comparison to the trouble developed in the accessories of the receiver. By accessories is meant tubes, antenna and ground connections and other additions which people have considered necessary on their receiving sets. A careful check-up on these accessories will generally reveal the source of trouble and prevent useless correspondence, delay and inconvenience to the user.

The power supply used with the receiver is designed for use on electric lighting and power lines varying between 100 and 125 volts and from 50 to 60 cycles. Where the voltage is constantly below 115 volts, however, the sensitivity of the set will be somewhat lessened. It is advisable to definitely determine this voltage in order to be sure that it is not in excess of 125.

The size of the antenna used with the receiver affects the set in sensitivity and freedom from interference. As the length of the antenna is increased, the sensitivity of the set increases, but above a certain length this effect is offset by a decease in selectivity.

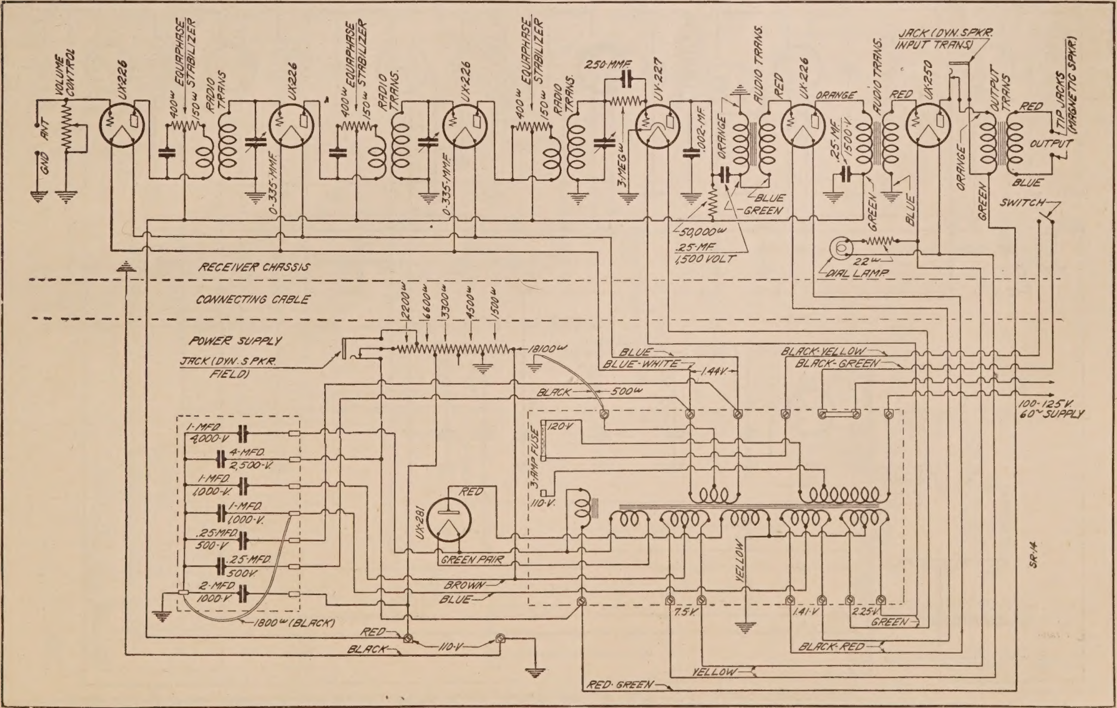

GND
ANT
VOLUME CONTROL
UX-226
400ω EQUAPHASE
150ω STABILIZER
RADIO TRANS
0-335-MMF.
UX-226
400ω EQUAPHASE
150ω STABILIZER
RADIO TRANS.
0-335-MMF.
UX-226
400ω EQUAPHASE
150ω STABILIZER
RADIO TRANS.
250-MMF.
3-MEGω
UY-227
.002-MF.
ORANGE
AUDIO TRANS.
RED
BLUE
-GREEN
50,000ω
.25-MF.
1,500 VOLT
UX-226
ORANGE
.25-MF.
1500-V.
AUDIO TRANS.
RED
GREEN
BLUE
UX-250
JACK (DYN. SPKR. INPUT TRANS)
ORANGE
GREEN
OUTPUT TRANS
RED
TIP JACKS (MAGNETIC SPKR.)
OUTPUT
BLUE
SWITCH
22ω
DIAL LAMP
RECEIVER CHASSIS
CONNECTING CABLE
2200ω
6600ω
3300ω
4500ω
1500ω
POWER SUPPLY
JACK (DYN. SPKR. FIELD)
18100ω
BLUE
BLUE-WHITE
1.44V.
BLACK
500ω
BLACK-YELLOW
BLACK-GREEN
100-125V. 60~ SUPPLY
1-MFD. 4,000-V.
4-MFD. 2,500-V.
1-MFD. 1,000-V.
1-MFD. 1,000-V.
.25-MFD. 500-V.
.25-MFD. 500V.
2-MFD. 1000-V.
1800ω (BLACK)
120-V.
3-AMP FUSE
110-V.
RED
UX-281
GREEN PAIR
BROWN
BLUE
YELLOW
7.5V.
1.41-V.
2.25V.
GREEN
SR-14
RED
BLACK
110-V.
BLACK-RED
YELLOW
RED-GREEN

Fig. 1. Both the receiver and power supply schematics are combined in this drawing representing the Freshman model 2-N-12 receiver and the 2N-60-S power source

The Steinite Model 261 and Supply

EMPLOYING four 226 tubes, a 227 detector and a 171-A audio power stage the Steinite model 261 receiver is made by the Steinite Radio Co., Chicago, Illinois, and Atchison, Kansas.

Stepped Inductance

Electrical details of the receiver and the power supply are disclosed in the schematic diagram, Fig. 1, on this page. It will be noted that the input stage is tuned by means of an antenna inductance having a number of taps. In the original model there were three inductance steps corresponding to three equal divisions of the broadcast band. However, since September, 1928, the number of steps in the inductance was increased to seven and is controlled by a seven-point switch located immediately back of the volume control knob on the receiver.

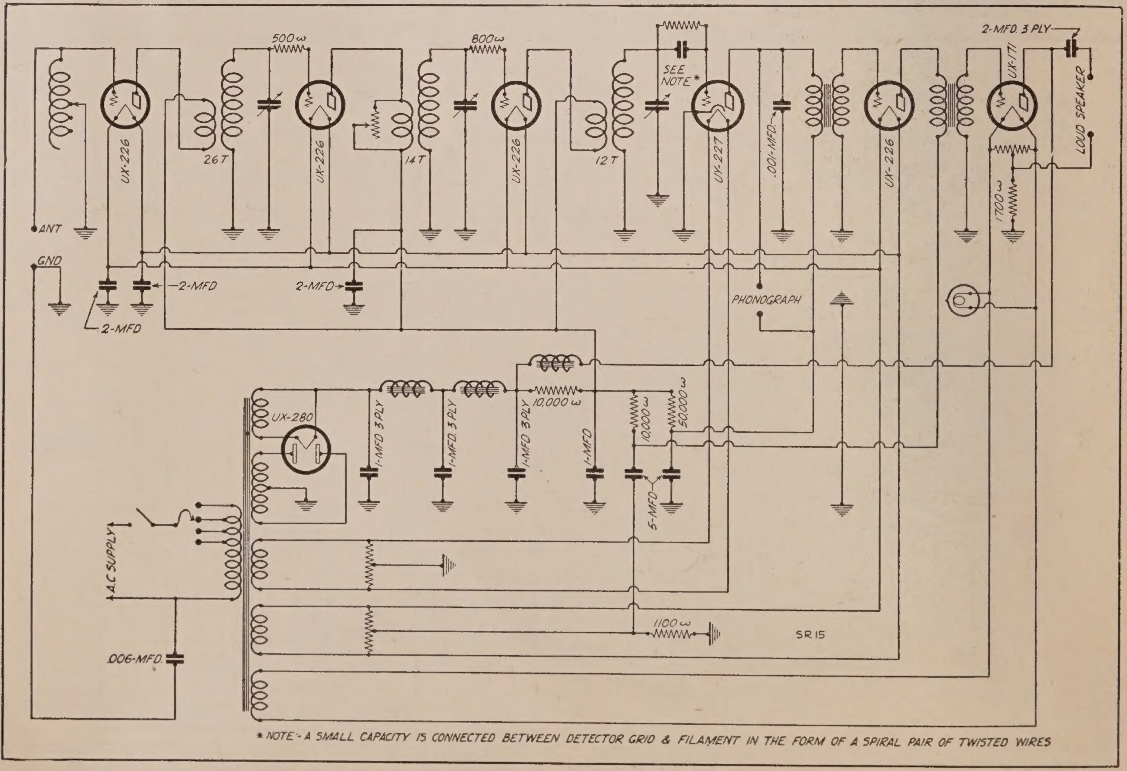
The receiver is a grid resistance stabilized tuned radio frequency set having three tuned stages and a semi-tuned antenna coupling stage. Arrangements are made for the employment of a phonograph pick-up unit, which is plugged into position across the primary of the first audio transformer.

Antenna Conditions

If the set is connected to a very short or a very long antenna, the operation of the antenna compensating switch will not be normal. The maximum volume for stations near the center of the broadcast band will be obtained when the antenna switch is on the left-hand point or right-hand point, depending on whether the antenna is too long or too short, respectively, and there will be a loss of sensitivity on one end or other on the wave band. It should be understood that a medium sized antenna which is run too close to a wall or roof has large capacity and works like an extremely long antenna. A good ground connection is also essential for the best operation of the set, since a high resistance ground may cause weak signals, broad tuning or hand capacity effect. If it is suspected that the receiver is not properly balanced, it may be retuned by setting the dial so that a weak signal between 250 and 350 meters is tuned in and then adjusting the variable condenser compensating plate until the signal is the loudest. These plates may be reached with a screw-driver through the openings in the condenser shield.

Voltage Under Load

Service men when testing the power unit should remember that the correct voltages will be obtained only when the power unit is operating in conjunction with the receiver chassis, which gives it the proper load. Thus a ground on one of the B plus leads tends to reduce the plate voltage while an open circuit tends to raise it. When incorrect voltages are obtained at the power unit terminals, it should not be assumed that the power unit is defective since a fault in the receiver could also cause the incorrect voltage. To determine whether or not the power unit is defective, it should be connected to a receiver chassis which is known to be in good condition and the voltage rechecked. Incorrect voltages will be obtained if any tube is removed, since the load is decreased. Incorrect voltages may also be obtained where the antenna is disconnected since the first r. f. tube may oscillate.



* NOTE - A SMALL CAPACITY IS CONNECTED BETWEEN DETECTOR GRID & FILAMENT IN THE FORM OF A SPIRAL PAIR OF TWISTED WIRES

Fig. 1. Both the receiver and power supply schematics are combined in this drawing of the Steinite Model 261 a.c. receiver

Howard Green Diamond Set, Model 8

KNOWN commercially as the Green Diamond, Howard's Model No. 8 manufactured by the Howard Radio Co., South Haven, Michigan, is described in the accompanying article.

As will be seen from an inspection of the schematic circuit shown in Fig. 1, the receiver is completely electrically operated and uses eight tubes, four of these being 226's employed in the tuned radio frequency stages, which are neutralized. The detector is the conventional 227. The fifth 226 tube is used in the first audio stage, while two 171's arranged in push-pull complete the power output stage.

Self-Contained Power Supply

A, B and C supplies for the operation of the receiver are produced by the 280 rectifier and its associated high and low voltage system. The loud speaker field of 2500 ohms, 4½ watts, forms a part of the filter in the rectifier system. Individual resistors in the plate circuit of the first, second, third and fourth radio frequency tubes serve to supply these plate circuits with the proper voltages. Resistance R-6 serves to drop the voltage for the plate of the detector to its proper value.

The audio frequency volume control is represented as R-3 and consists of a variable resistor placed across terminals 1 and 3 of the first audio transformer. This transformer has a tap at terminal 2 so that when a phono pick-up is used, it is placed across terminal 2 and one side of SW-3. When the switch is on the phonograph side, only a portion of the primary winding is in the circuit, whereas when the switch is on the radio side, the entire primary of the first audio is utilized.

Sensitivity Control

Volume control for the radio frequency end of the Green Diamond is made by manipulation of resistance R-1 located between antenna and ground with the movable arm going directly to the grid of the first 226. By controlling the input r. f. voltage, the remainder of the radio frequency stages are operating at a maximum value all of the time, this permitting the neutralization of the receiver at a desirable condition throughout the radio frequency end of the set. Thus for sensitivity, the r. f. volume control is used, while for loudness of signal the a. f. volume control is employed. The method of neutralization is from the grid of the first tube through the neutralizing condenser to a neutralizing tap on the succeeding secondary inductance. This method is followed throughout the four stages so neutralized. Each stage is bypassed in the plate circuit as well as in the filament circuit, so as to assure complete stability of the receiver.

High or Low Lines

A two-way switch on the power supply enables the operation of the set either from 110 or 120 volts, depending upon the condition of the line. In addition to that there is provided an "on-off" switch by means of which the entire receiver may be started or stopped.

A special Howard speaker is used with the Green Diamond and its field is energized by the rectifier circuit.

Transformer 4 is the push-pull output which feeds inductively the voice coil of the speaker, a reversed or hum neutralized winding being incorporated in that circuit to eliminate a. c. hum.

Covers Full Band

Tuning range of this set is from 200 to 545 meters, or from 1500 to 550 k. c., covering the complete government allocation of wavelengths over the broadcast band.

The left-hand switch on the panel when snapped to the right is in position for radio reception. When snapped to the left, it brings into operation the special audio system for playing phonograph records electrically.

The right-hand volume control prevents overloading of all tubes by governing the strength of signal entering the receiver, while the left-hand volume control prevents overloading of the audio frequency amplifier tubes only.

Type Numbers Shown

Type numbers of all of the parts employed in the completed receiver are shown in the schematic circuit for the benefit of service and repair men who may have occasion to write the factory for such parts.

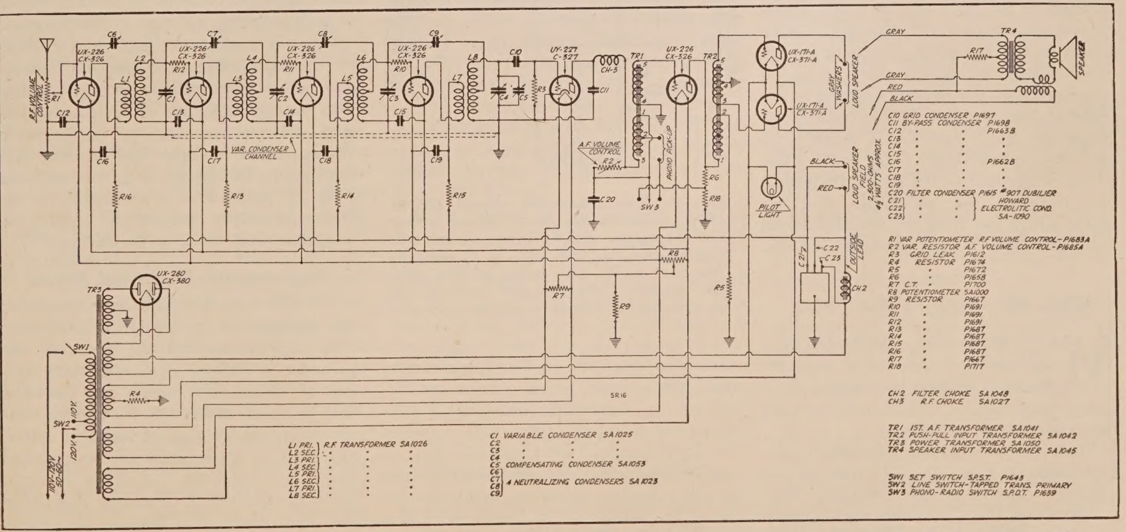

R.F. VOLUME CONTROL
UX-226 CX-326
UY-227 C-327
UX-171-A CX-371-A
UX-280 CX-380
VAR. CONDENSER CHANNEL
A.F. VOLUME CONTROL
PHONO PICK-UP
PILOT LIGHT
GRAY
RED
BLACK
LOUD SPEAKER
LOUD SPEAKER FIELD 2,500-OHMS 4½ WATTS APPROX.
OUTSIDE LEAD
SPEAKER
110V.
120V.
110V-120V 50-60~
SR16
C10 GRID CONDENSER P1697
C11 BY-PASS CONDENSER P1698
C12 " " P1663B
C13 " " "
C14 " " "
C15 " " "
C16 " " P1662B
C17 " " "
C18 " " "
C19 " " "
C20 FILTER CONDENSER P1615 #907 DUBILIER
C21, C22, C23 " " HOWARD ELECTROLITIC COND. SA-1090
R1 VAR POTENTIOMETER R.F VOLUME CONTROL-P1683A
R2 VAR. RESISTOR A.F. VOLUME CONTROL-P1685A
R3 GRID LEAK P1612
R4 RESISTOR P1674
R5 " P1672
R6 " P1658
R7 C.T. " P1700
R8 POTENTIOMETER SA1000
R9 RESISTOR P1667
R10 " P1691
R11 " P1691
R12 " P1691
R13 " P1687
R14 " P1687
R15 " P1687
R16 " P1687
R17 " P1667
R18 " P1717
CH2 FILTER CHOKE SA1048
CH3 R.F. CHOKE SA1027
TR1 1ST. A.F. TRANSFORMER SA1041
TR2 PUSH-PULL INPUT TRANSFORMER SA1042
TR3 POWER TRANSFORMER SA1050
TR4 SPEAKER INPUT TRANSFORMER SA1045
SW1 SET SWITCH S.P.S.T. P1643
SW2 LINE SWITCH-TAPPED TRANS. PRIMARY
SW3 PHONO-RADIO SWITCH S.P.D.T. P1639
L1 PRI., L2 SEC. R.F. TRANSFORMER SA1026
L3 PRI., L4 SEC. " " "
L5 PRI., L6 SEC. " " "
L7 PRI., L8 SEC. " " "
C1 VARIABLE CONDENSER SA1025
C2 " " "
C3 " " "
C4 " " "
C5 COMPENSATING CONDENSER SA1053
C6, C7, C8, C9 4 NEUTRALIZING CONDENSERS SA1023

Fig. 1. This schematic circuit gives all of the electrical details of the Howard Green Diamond Model 8, with a table of type numbers for all condensers, resistors, chokes and transformers

With the PROFESSIONAL SET BUILDER

Proper Voltage Measurement

W. D. MURPHY, 312 Hendricks Ave., Evansville, Ind., writes: "Can you give me a circuit of the tester to obtain the voltage readings of the grid bias on a. c. tubes?"

In the schematic circuit shown in Figure 1 are illustrated two points at which voltage readings for a. c. tubes may be secured. It will be noted that when a high resistance voltmeter is placed across the extremities of the grid biasing resistor, the voltmeter will register the voltage actually applied to the grid of the tube. On the other hand, when the high resistance voltmeter is clipped on between the plate of the tube and the center tap of the filament transformer (or the center tap of the resistance across the filament line), the reading will be the actual voltage applied to the plate.

Gives False Reading

The plate voltage should never be measured between the plate and the B minus, because when a. c. tubes are used, this reading would be a fictitious one, since it would include the voltage applied to the grid of the tube. Thus, if one measures from the plate of a 171-A to the B minus a voltage of approximately 220 will be secured. This is not actually the voltage applied to the plate of the tube, but is the voltage between the plate and the B minus and includes approximately 40 volts bias, which is applied to the grid. In testing for voltages, the schematic diagram above illustrates how the test should be made in order to get accurate results.

This May Save Tube Price

MANY times when the heater of a 227 tube burns out it may be fused together by means of a five prong adapter which comes with the majority of test sets.

Place the five prong adapter in the 171 socket and put the 227 tube in the adapter. Turn on the receiver. The 5 volts from the 171 socket will usually fuse the ends of the broken heater wire together.

Why Dial Readings Change

FRED HOERNER, 466 Weidler St., Portland, Ore., says: "I have noticed in many of the manufactured radio sets it makes very little difference in the dial reading how long the antenna is. I note they read the same whether the antenna is 2 ft. long or 200 ft., thus permitting calibration of the dials in wavelength or kilocycles. In the sets that I have built the dials change considerable with different length antennas and in different locations. If it is possible without much inconvenience on your part to tell me how this is done, I would appreciate it very much."

A Production Problem

It is only natural in the production of radio receivers in large quantities, that the industry must design its receivers so regardless of the conditions under which they will operate, the functions will be identical. This is possible in a factory set, first because of the complete shielding and next because the circuit is so designed that a small input voltage will be satisfactory for r. f. amplification, detection and audio amplification throughout the entire set. This is especially true when three or four stages of tuned radio frequency are utilized, involving a gang condenser.

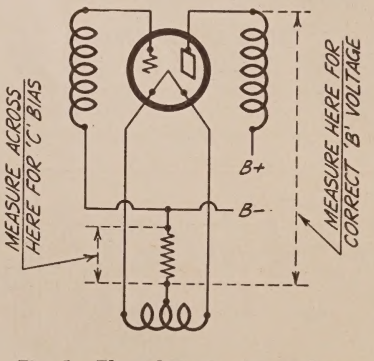

MEASURE ACROSS HERE FOR 'C' BIAS
B+
B-
MEASURE HERE FOR CORRECT 'B' VOLTAGE

Fig. 1. The schematic circuit shown above indicates the points across which measurements should be made for the C bias and for the correct B voltage. The text at the beginning of this article explains the proper method of measuring to secure accurate voltages

If the input coil were so designed that maximum pick-up were possible from the aerial it would be necessary for compensating means to be provided to hold the calibration constant throughout the broadcast range. Naturally this would involve more controls than the average buyer would care to consider. As a result, in order to permit single dial operation and extreme facility of tuning the antenna input circuit is so designed that regardless of the aerial length used, the tuning remains constant.

Greater Pickup

In the custom built sets the antenna inductances have usually been designed to yield as great an antenna pick-up as is possible, leaving it to the builder to reduce this pick-up in the event it proves too strong for sharp tuning.

Reactions of Human Ear

AT a recent meeting of the Acoustical Society of America, Dr. Donald A. Laird, of Colgate University, gave an extremely interesting lecture on the reactions of the human ear and nervous system to comparative variations of volume and sound. According to Dr. Laird, it is the pitch or tone of noise that is responsible for shattered nerves, and not the volume, as would at first seem to be the case.

Experiments in Sound Room

Dr. Laird conducted experiments with his students in a special sound-room, and thereby learned the facts of the peculiar reactions of the nervous system to noise. He found, for instance, that a small reduction in volume was accompanied by a great sense of relief, although in some areas of the musical scale, an identical reduction brought much greater relief. This was due to the fact that it was the tone of the noise, rather than the volume, that irritated. The general reaction found was comparable to that of rubbing a finger over sand-paper, or biting into brittle candy. As a matter of theoretical interest, Dr. Laird said that he had found men's voices to be the least annoying of all noises. "Given the right pitch," he told the Press, "a room can be relatively quiet, but still annoying." This phrase of Dr. Laird's expresses, perhaps more accurately than any other, the condition to be found in the average American living room today. By this we refer to the living room as being, presumably, the radio room. Here the proud owner has installed his radio receiver, a set that he probably runs most of the time, with, perhaps, an occasional change of station, or even a reduction of the volume when it becomes too impossible. Otherwise it goes on playing and he becomes accustomed to it. But because he does become accustomed to it does not necessarily mean that it is good. On the contrary, nine times out of ten the set is not "tone adjusted," and, as Dr. Laird says, "even though the room be relatively quiet, it is still annoying."

This is one thing that radio set manufacturers do not incorporate in their receivers, and that people themselves neglect. Of course, it is true that so far there has been little that the owner of the average factory-built set could do, unless he undertook a major operation on its very vitals, a procedure to be discouraged in this day of intricate multi-tube receivers. Also, merely changing the tone of the set or speaker once will not suffice.

Using the Soft Pedal

A tone control should be able at a moment's notice to vary the entire timbre over a wide range. A control of this sort is really a soft pedal for the radio set and it is very simple to make, being entirely external, and requires no tampering with the works. It consists of a stepless variable resistance of from about zero to 500,000 ohms, in series with a ¼ mfd. condenser. This combination is connected across the loud-speaker terminals of the set, and the variation of the resistance changes the tone of the output from clear and sharp to soft and deep, through the simple expedient of by-passing more or less of the higher frequencies. The table type Clarostat does very well for this purpose, as it is enclosed in a metal case equipped with a long connecting cord so that the control may be moved wherever one goes, be it to bridge table or bedside. One may instantly vary the pitch for each particular selection.

Damping the Sopranos

Men's voices, as a rule, should come out clear and crisp, while ambitious sopranos and jazz bands are generally greatly improved by application of the new soft pedal, gently muting the highs and encouraging the lows.

It will be found that if the tone is always kept at the proper pitch, a great deal more volume may be used without the ear being conscious of it. Whereas, with the tone gone, even the gentlest murmur is irritating, and an otherwise perfect program loses its charm.

Dynamic Speaker Qualities

IN spite of the fact that the dynamic speaker is now firmly entrenched in the mind of the radio fan as an exceedingly fine reproducer, there are still many points in connection with its operation which have been overlooked by the average fan. An extremely interesting booklet on dynamic speakers has recently been issued by the International Resistance Co., 2006 Chestnut St., Philadelphia, Pa., and much of the material contained in Engineering Bulletin No. 6 can be read with profit by set builders and service men.

We are quoting from one of the interesting paragraphs in this bulletin: "A very important factor which influences the frequency characteristic of any loud speaker is the impedance of the voice coil. It is important to know the value of this impedance, its alteration with change in voice frequency and relative values of its resistance and reaction component. The ideal loud speaker would have a constant impedance of pure resistance. This ideal while not realized in practice is more closely approached in the dynamic type of speaker than in any other. The impedance increases with the higher frequencies, thus reducing the electrical input at these frequencies. Individual makes utilize voice coils having from one to as many as several thousand turns. In American practice the impedance of the moving coil which usually is wound with a 100 to 200 turns of fine wire is of the order of magnitude of 10 ohms in the lower frequency range. There is on the market at least one loud speaker with a voice coil consisting of a single turn of thin copper ribbon having an impedance of less than .001 ohms."

With respect to the reproduction of the lower frequencies, the method of mounting is very important and is detailed at length in the bulletin prepared by the International Resistance Co. Professional set builders and service men desiring a copy of same may secure it upon application to the company at the address given above. Ask for Engineering Bulletin No. 6.

Magnetization of Watches

IN the March, 1929, issue of this magazine, Ampere Andy cautions professional set builders and service men against working close up to a dynamic speaker on account of the possibility of their watch being magnetized. One of our readers disagrees with Andy and says so in such an interesting manner, that we are printing herewith his brief letter:

"Under the heading 'Ampere Andy's Assistors' there is an article concerning the magnetization of watches by dynamic speaker fields. I am inclined to disagree with Andy about this and put the blame on other pieces of apparatus because my wrist watch was magnetized many times before I touched a dynamic speaker. Then, too, it is very seldom that a dynamic speaker is worked on while it is in operation.

Many Other Causes

"There are several other places where a watch will get a good dose of magnetism, such as testing meters, nearly all of which have a good sized permanent magnet contained therein. The soldering iron when used on direct current makes an excellent electro-magnet. Automatic relays also create quite an electro-magnetic field. Tools become magnetized when used on magnetic speakers for adjustment. It is practically impossible to prevent magnetization of a watch under such conditions, so the only cure is to give the watch a demagnetizing treatment with a weak a. c. field."

The writer of this interesting note is L. H. Wegner, 204 11th St., Milwaukee, Wis.

Ferranti Audio Booklet

THERE has been a great deal of confusion regarding the use of dynamic speakers with power amplifiers, particularly where push-pull amplification is used in the last stage as practically none of the speaker input transformers have center tapped primaries for push-pull operation.

A recent booklet on Audio Frequency Transformers and Radio Products with instructions for building power amplifiers has been issued by Ferranti, Inc., 130 W. 42nd St., New York, N. Y. In that booklet are given instructions for proper means of coupling push-pull pull output circuits to existing dynamic speaker transformers.

In addition to material on the audio transformer, the Ferranti booklet also contains data on the matching of transformer impedance between power tubes and speakers. A number of tabulations are given so that the reader may see the manner in which the proper matching may be accomplished.

The latter part of the booklet concerns itself with diagrams and parts lists for the construction of power amplifiers and power supplies.

There is also some space devoted to

Ferranti meters, resistances and condensers. Set builders and service men who are interested in audio work would do well to secure a copy of the booklet and peruse it carefully since many of the items shown may come in handy in their work.

19 Twisted Pair in Lead

RADIO men installing public address systems will welcome the news that No. 19 twisted pair, in lead, may be obtained from the Crescent Insulated Wire & Cable Co., Trenton, N. J. We are advised that this wire is stocked at all of this company's branches.

It is interesting to note that the talkies industry is using large quantities of this wire in their California studios. It is especially desirable because of the small number of turns per foot, which reduces the capacity of the conductor and, therefore, does not cut off so many frequencies used in talkie work. Many manufacturers of public address systems are recommending this particular wire because it enables service men and installers to perform a very creditable job without running into the difficulty usually encountered when unsheathed wire is utilized. Those radio men contemplating prospective installations should communicate with the Crescent interests to determine their nearest supply.

Matching of Impedances

ATTENTION should be called to the necessity for matching the impedance of the dynamic input speaker to that of the 250 tube. Many professional set builders and service men have complained of poor tone quality when using certain dynamic speakers on a 250 tube. In many cases the trouble can be traced to the disparity between the tube and transformer impedance. Some of the manufacturers of public address systems now rate their output transformers at an impedance of 4000 ohms at 100 cycles with 55 mils of current in the circuit. This is for the purpose of matching the impedance of the 250 tube. Consequently no general purpose input transformer will suit the 171, 245 or 250. In some cases it is desirable to remove the dynamic input transformer and substitute one that is especially made for a particular power tube at its maximum current drain. It has also been noticed by set builders and service men that the matching of impedances between the dynamic input and the power tube has eliminated the tube arcing on high frequencies, this arcing having been one of the complaints lodged against the 250 tube during the early days of its production.

Inductances Not Interchangeable

READERS of this department interested in the conversion of receiving sets using the 201-A into receivers using the 222 or 224 tubes should remember that it is impractical to use r. f. transformers having the same number of primary turns. For example: a transformer having 15 or 20 turns in the primary and which was used with a 201-A tube would not be suitable for the use of a 222 or 224 tube on account of insufficient primary. It is, therefore, necessary when making such a conversion, to see that the r. f. transformer is properly designed for the particular tube being employed.

A. C. Grid Dip Meter

KEEPING up with the alternating current operated trend, our laboratory staff has redesigned the grid dip oscillator illustrated on pages 94 and 95 of the November, 1928, issue of this magazine and converted it into a. c. operation. On account of space limit in this particular issue we will not be able to give the details of the conversion scheme but the succeeding number, the November issue, will contain full details of the change. Several set builders have advised us they constructed the previous model of the grid dip oscillator and are using it to good advantage. However, the original model involves the use of batteries, whereas the contemplated design to appear in the next issue has its own B supply self-contained.

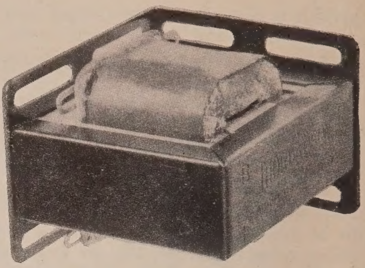


Fig. 3. The transformer illustrated above is one of Thordarson's replacement transformers made especially for professional set builders and service men. One of the features of the new unit is the fact that it may be mounted in almost any position. It is an ideal arrangement for replacement in sets where a transformer has been burned out

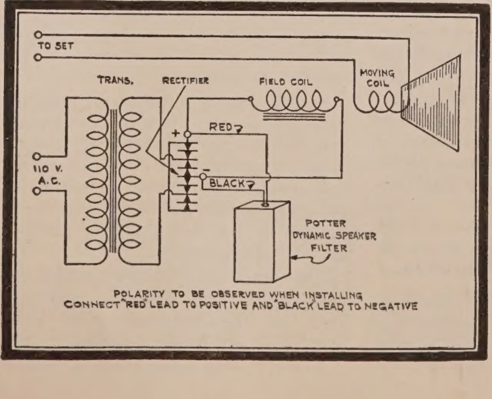

TO SET
TRANS.
RECTIFIER
FIELD COIL
MOVING COIL
RED
BLACK
+
-
110 V. A.C.
POTTER DYNAMIC SPEAKER FILTER
POLARITY TO BE OBSERVED WHEN INSTALLING
CONNECT "RED" LEAD TO POSITIVE AND "BLACK" LEAD TO NEGATIVE

Fig. 2. Presence of a. c. hum in alternating current operated dynamic speakers may be eliminated by the addition of a speaker filter. This applies in such of the a. c. operated dynamic speakers as use low voltage type rectifiers of the Westinghouse, Kuprox, Elkon and other dry types. The dynamic speaker filter is placed across the positive and negative terminal of the field coil at the rectifier. The method of doing so is shown in the diagram at the left

Adjusting Automatic Relay

DESPITE the a. c. craze there are thousands of battery sets still in operation. In many of these jobs the Yaxley 440 automatic relay is being used to relieve the tedium of looking out for battery charging.

In the instructions accompanying the 440 relay it states that the relay should be mounted flat. In 95 cases out of a 100 the armature will trip properly when the battery's voltage is up to the required value. However, in a limited number of cases it is necessary to make a slight adjustment in order to throw the armature either closer or farther away from the magnet to get the proper trip. An adjustment screw has been provided on the contact bracket adjoining the magnet with the small wire winding. This particular adjusting screw is at the left and bottom of the two contacts governing the closing of the a. c. line for the charger. By turning this screw either to the left or right it is possible to set the armature movement so that the armature will either trip earlier or later when the battery voltage has been brought to its proper value.

While much the same result may be obtained by tipping up one end of the relay, nevertheless it is not recommended because the armature is then partly actuated by gravity. The set screw referred to may be further identified by the fact that the shank is slotted and it is the only screw of its kind in the relay.

(Continued on page 120)

Sign Flashers Emit Interference Like a Simple Transmitter

Primary and Secondary Radio Interference Set Up; Each Type Needs Special Study and Cure

By W. K. FLEMING*

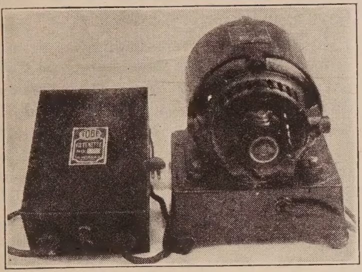


Fig. 5. In this photograph a filter has been attached to a rotary converter to eliminate radio interference

ONE of the most peculiar things about radio interference is the manner that seemingly simple phases of interference have of developing into really intricate problems. This is the case with sign flasher interference. To all intents and purposes, what could be easier than to remove the interference set up by opening a low tension circuit? Yet upon careful analysis, it is found to be one of the most difficult of radio interference problems to overcome.

In most cases of interference, the disturbance picked up by the set is caused by oscillations or disturbing impulses set up in the power supply line to the set. These impulses may cause interference, due to their being conductively coupled to the set, as well as to the fact that the power line is radiating waves which are picked up by the antenna system. In either case, attaching a filter directly at the source of the interference is generally all that is necessary to reduce both effects to such an extent that they will not cause any objectionable interference. This type of interference may be designated as primary interference to distinguish it from other interference which may be set up by the apparatus and which we will term secondary interference.

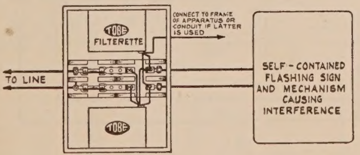

TOBE
FILTERETTE
TOBE
CONNECT TO FRAME OF APPARATUS OR CONDUIT IF LATTER IS USED
TO LINE
SELF - CONTAINED FLASHING SIGN AND MECHANISM CAUSING INTERFERENCE

Fig. 1. This diagram shows how a filter may be attached to a self-contained flashing sign

Primary interference set up by sign flashers can generally be supressed by an inductive capacitive type filter.† The secondary type of interference, however, is another story. Fortunately, not all sign flashers create objectionable secondary interference. In fact, in most cases, this interference is not of sufficient intensity to be objectionable unless the sign is operated in close proximity (under 100 feet) to the radio set or antenna system.

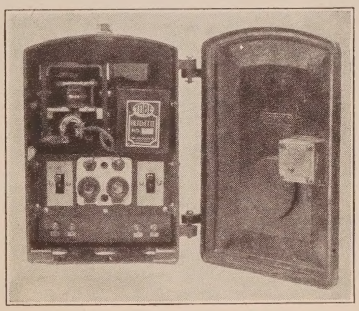


Fig. 6. Here is shown an American Gas accumlator mechanism for operating street blinkers with a filter incorporated to eliminate radio interference

The difficulty of overcoming what we have termed secondary interference is due to the fact that this interference is really very similar in character to that produced by standard transmitting apparatus. In some cases, the circuit is almost identical with unlawful types of transmitting circuits; that is, circuits wherein the antenna is conductively coupled to the transmitter rather than inductively coupled. The difficulty of overcoming this interference is due to the fact that the flasher radiates from the load circuit what might be considered highly damped waves.

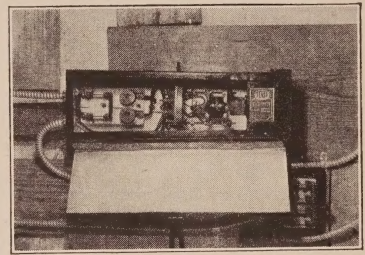


Fig. 7. Another mechanism for operating street blinkers made by the Essco Mfg. Co. is illustrated above, showing the filter incorporated for the elimination of radio interference

Types of Sign Flashers

The simplest type of sign flasher is that in which the mechanism is actuated by a thermostat. Interference caused by this type of mechanism is readily suppressed provided the mechanism, as is generally the case with small blinkers, is closely associated with the sign and enclosed in the sign housing. In this case the secondary interference set up is not of sufficient intensity to be objectionable. The diagram in Figure 1 shows how the filter should be attached to this type of flasher.

If the flasher mechanism is operated at a considerable distance from the sign, as shown in Figure 2, the secondary interference set up will probably be objectionable. In this case an additional filter will probably be required, as shown in the dotted lines in Figure 2.

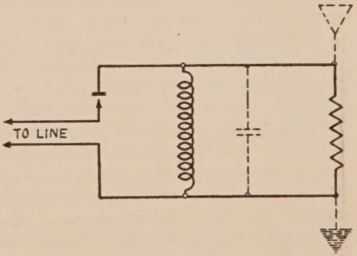


Fig. 4. This is a simple diagram showing how secondary interference can arise when one compares the similarity of this circuit to that of the standard simple type of transmitter

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*Chief Engineer Tobe-Deutschmann, Inc.

†Tobe Filterette No. 131-5.

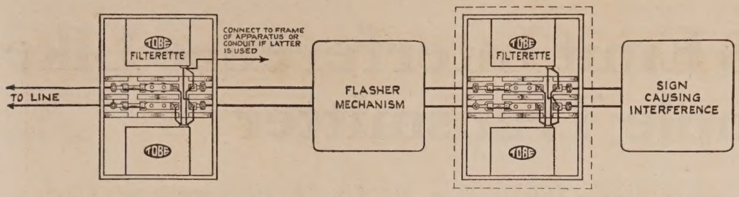

CONNECT TO FRAME OF APPARATUS OR CONDUIT IF LATTER IS USED
TOBE
FILTERETTE
TOBE
TO LINE
FLASHER MECHANISM
TOBE
FILTERETTE
TOBE
SIGN CAUSING INTERFERENCE

Fig. 2. In this diagram the sign is operated at a distance from the flasher mechanism and secondary interference will probably be set up. The sketch shows how a filter may be placed in the circuit

Motor Flasher

The most universal type of sign flasher is that in which the mechanism is actuated by a motor. The primary interference set up by this type of flasher is generally suppressed by a standard inductive capacitive type filter, similar to that required for the simpler types of sign flashers. The circuit in Figure 3 shows how the filter should be installed.

The secondary interference created by motor driven sign flashers is usually more severe than that created by the simpler flashers, due to the fact that the flasher mechanism is frequently operated at a considerable distance from the sign. An additional filter, as in the case of the simpler type of flasher mechanism, is therefore often necessary to suppress the secondary interference.

The type of flasher mechanism employed for traffic lights and safety signs is generally of the solenoid or magnetic type. This type of mechanism is also employed for actuating larger types of signs. The primary type of interference is generally suppressed by installing a filter in a similar manner to that employed in the case of a thermostat or motor driven type of sign flasher mechanism. The secondary interference, however, is extremely difficult to overcome provided the sign and the mechanism are not installed in the same housing. The reason for this can be readily understood by comparing the similarity of this type of circuit, as shown in Figure 4, to a standard, simple type of transmitter. Where the sign is installed at a considerable distance from the flasher mechanism, the wiring between becomes the antenna system of a low potential transmitter, emitting highly damped waves which are capable of traveling over a considerable distance.

It is fortunate that a great many of the smaller signs and blinkers which employ this type of mechanism are really self-contained units, wherein the mechanism and the light are in the same housing. In this case, the standard inductive capacitive type filter† is generally quite effective in suppressing the interference.

When several of these lights are controlled from one central system, or when there is considerable distance between the flasher mechanism and the sign, we are, as before mentioned, confronted with one of the most difficult problems of secondary interference. A specially constructed type of filter must be used in order to secure satisfactory suppression of this interference.

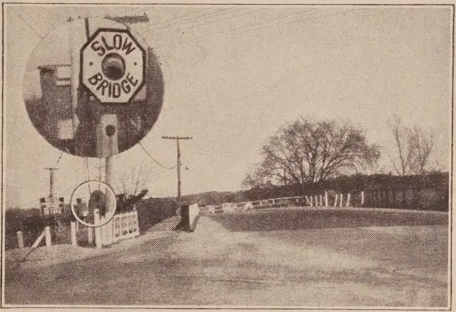


Fig. 8. Residents of Walpole, Mass., have noted the disappearance of certain raucous disturbances which were making radio reception in that vicinity unbearable. The mystery was solved when it was found that the stop blinker shown in the above photograph was causing the interference. The proper filter eliminated the disturbance

Character of Interference

To suppress satisfactorily the interference created by sign flashers, it is first necessary to determine whether the interference is primary or secondary in character. If it is primary in character, it is coming in over the power lines. If it is secondary in character, it is probably being picked up by the antenna system of the seat. This classification of interference applies in the majority of cases. In some instances, however, secondary interference is picked up by the power lines and thus conveyed to the set, even though a filter is employed in the primary side of the flasher. In this case, as well as in the case of direct secondary radiation as picked up by the antenna system, it is necessary to use a filter which suppresses both primary and secondary radio interference; otherwise, complete elimination of the interference will not be secured.

In some types of installation, the secondary interference may be reduced by carrying the wires from the flasher mechanism to the sign in metal conduit, which it is usually advisable to ground at two or three points; that is, at the sign flasher, in the middle of the conduit and at the end of the conduit. No hard and fast rule, however, can be laid down for this type of installation, as it quite frequently happens that grounding the conduit increases the interference rather than decrease it. This latter phenomenon is undoubtedly due to the fact that the conduit in this case is acting as a radiator, and the ground leads, therefore, really increase the length of the antenna effect and the consequent secondary interference, rather than decreasing it.

The most satisfactory arrangement for a flashing sign is one in which the flasher mechanism and the lights are so placed that the leads to the lamps are extremely short. These leads should be carried in conduit or the back of the sign should be enclosed in metal. In fact, an ideal type of flashing sign would be one constructed entirely of metal. Where this construction is possible, secondary radiation is reduced to a negligible quantity, due to the large absorption effect of the metal sign.

(*Continued on page* 122)

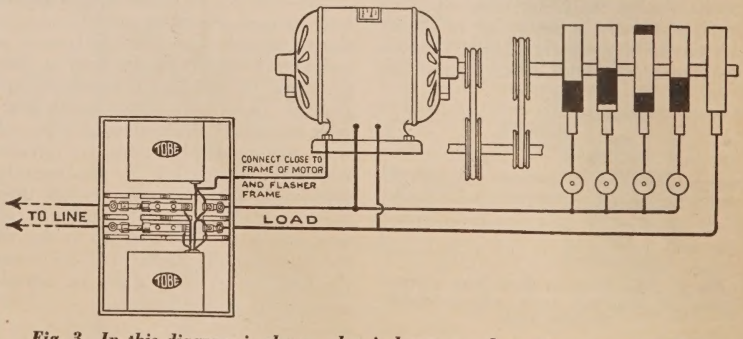


Fig. 3. In this diagram is shown what is known as the motor type of flasher and the necessary filter connections to eliminate interference

The ABC of Radio

BEGINNING in the January, 1929, issue of this magazine, on page 97, we printed the schematic and graphic diagrams of the detector portion of a five tube receiver being built in accordance with instructions in the lessons of the Junior Radio Guild. Lesson No. 2 contains the schematic and graphic diagrams for the detector part of the set.

In this article we are giving the schematic and graphic diagrams contained in Lesson No. 3, which represent the audio frequency amplifier portion of the set involving two tubes, and the schematic and graphic from Lesson No. 4, which covers the radio frequency amplifier, which portion also uses two tubes.

The list of parts for the complete receiver is given in this article with a separation indicated for each of the different stages. Those who wish the lesson sheets of the Junior Radio Guild may secure same by writing this department.

Sequence of Building

To secure maximum enjoyment from the set, the sequence in which it should be built is as follows: The detector circuit is first put in in accordance with diagrams, Fig. 6 and Fig. 7, on page 97 of the January, 1929, issue. Data on this first step is contained in Lesson No. 2. And the next lesson, which is No. 3, is the audio amplifying end of the set, represented by Figs. 13 and 16 in this article. The step after that is the addition of the radio frequency amplifying end, detailed in Fig. 20 and Fig. 21. Analyzing the schematic shown in Fig. 20, it will be seen that a screen grid tube is used in the first stage, with a 201-A in the second. This radio frequency stage is followed by the regenerative detector, which also uses a 201-A tube. After the detector, come the two stages of audio with a 201-A in the first stage and a 112-A tube in the output.

It is quite likely that those who have built only the detector circuit and the audio stages, will find that they are limited somewhat as to the distance over which they can receive and selectivity is not quite as good as it might be. However, it is the addition of the radio frequency amplifier, shown in Fig. 20 and Fig. 21, that allows the receiver to pick up signals over a greater distance and at the same time increases somewhat the selectivity of the set.

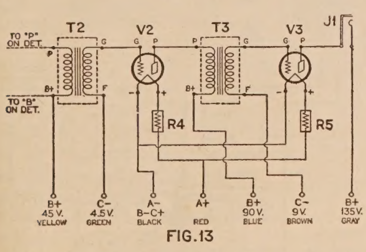


FIG.13

Fig. 13. This schematic diagram is of the two stage audio amplifier, which is a part of the completed five tube receiver

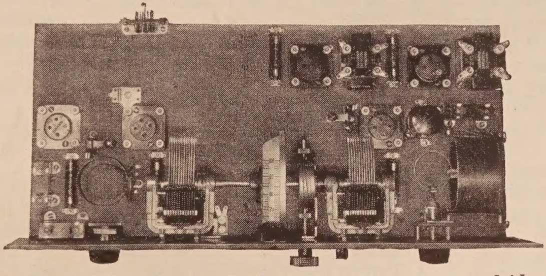


Fig. 1. This photograph shows all of the apparatus laid out for the completed five tube receiver. The wiring has not been shown in this photograph

Center Tapped Coil

It will be noted by referring to Fig. 6 on page 97 of the January, 1929, issue that the antenna coil is a center tapped arrangement, and by referring to the schematic shown in Fig. 20, it will be seen that the coil T1 now goes into the detector circuit instead of being in the antenna circuit. This coil T1 is of the type that permits the neutralization of the second radio frequency amplifying tube, the neutralization being accomplished by means of the midget condenser C7, shown in the diagram. In the case of the detector plate circuit, it goes to the primary of the audio transformer T2 shown in Fig. 13, instead of the head phones being used.

In the event that the receiver is being built from the beginning as a completed unit, then the order of reading of the schematic diagrams would be Fig. 20 for the radio frequency, Fig. 6 for the regenerative detector, and Fig. 13 for the audio amplifier.

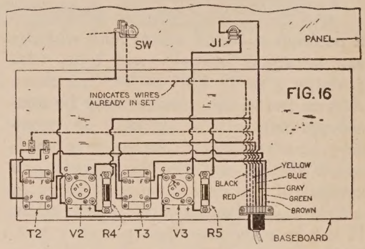


Fig. 16. This diagram is a graphic wiring diagram for the audio frequency amplifier, whose schematic circuit is shown in Fig. 13

In noticing the photographs shown in Fig. 1, which gives an idea as to the layout of all of the parts but does not show any wiring, it will be observed that the first two sockets at the left represent the first and second radio frequency tubes. The detector socket is the one just ahead of the right-hand variable condenser controlled by the drum dial. The two sockets for the audio stages are those shown at the right rear of the baseboard.

Neutralization of Tube

After the receiver has been constructed and placed in operation, perhaps the only point that might require some explanation is the neutralization of the second radio frequency amplifier tube. According to the instructions in the Junior Radio Guild lesson, the set screws on the r. f. tuning condenser C4 should be unloosened and this condenser should be rotated by hand over a small arc, says 10 points or less. It will be noted as the condenser plates are rotated that two distinct and unequal whistles will be heard at the point where the station is tuned in. The main idea is to slowly turn the adjusting screw on the neutralizing condenser first one way and then the other, until

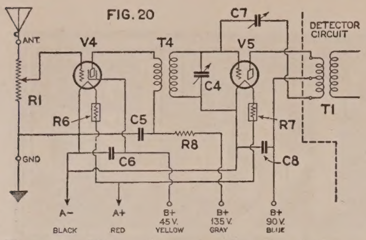


Fig. 20. The schematic circuit of the radio frequency amplifier is shown above

a position is found where both whistles are of equal intensity and tone, with perhaps a silent spot in between them. At this point, the receiver may be considered neutralized. It may be necessary in carrying out the above procedure to slightly advance the regeneration control of the detector circuit so as to obtain a small amount of regeneration. If the receiver has been properly neutralized, all of the squeals will have vanished when the station is received, provided, of course, that the regeneration control has been completely retarded. When you are sure that the receiver is satisfactorily neutralized, run the dial up to 100, push the rotor section of the r. f. condenser all in, tighten the set screws, and then the receiver is completely adjusted, ready to operate.

Data on the construction of the antenna for the receiver is contained in Lesson No. 1, while Lesson No. 2 gives an idea of the placing in sequence of the B battery and the C battery used with the receiver.

S. W. Adapter Next

According to information received from the Junior Radio Guild, the fourth lesson is the last of the series actually concerned with the construction of a complete five tube radio receiver. Lesson No. 5, which will follow, describes just how anyone can build a simple short wave adapter, which may be used with the present receiver to tune in on the signals being transmitted on short waves. As many of the readers know, there is considerable broadcasting on short waves and signals from these stations may be received over almost incredible distances. In addition to that, if the builders of the sets desire it, they may pick up telegraphic communication on short waves, both of a commercial and an amateur nature. Constructional data on the short wave adapter will be included in a latter issue of this magazine.

Early Condenser Uses

WHILE mishandled condensers often cause unpleasant shocks to careless radio men and experimenters, that is not their prime function today. Yet time was when the earliest forms of condensers were employed to shock animals and man. According to the Dubilier engineering staff, which has made an extensive study of the history of condensers, it appears that almost two hundred years ago the condenser phenomenon was discussed by learned and lay persons with as much excitement as we now discuss radio and aviation.

Gralath, one of the electrical experimenters of the eighteenth century, maintained that the discharge of the early condensers or Leyden jars, caused nose bleed with some persons. He wrote to one Reaumur, and referred to "a new and terrible experiment," and said that his arm and body "were affected in a manner more terrible than I can express." The Abbe Nollet, in France, used to kill birds with the discharge to entertain the ladies of the court. Gralath tried to emulate him but succeeded in killing beetles and worms. Later, by grouping several Leyden jars, he succeeded in killing birds easily.

Detector

1	Hammarlund Midline condenser .0005 mfd
1	Hammarlund PCT-23 choke coil
1	Hammarlund r. f. choke coil No. 85
1	Hammarlund drum dial FDB-1
1	Electrad Tonatrol type A
1	Electrad bypass condenser .001 mfd
1	Electrad grid leak condenser 0.25 mfd
1	Durham grid leak 5 megohm
1	Benjamin socket
1	Durham single resistor mounting
1	Amperite type 1-A
1	Yaxley midget battery switch No. 10
1	Yaxley cable connector and plug type 660
1	7x21-inch drilled panel

Audio Stages

2	Thordarson 3½ to 1 audio transformers
2	Benjamin sockets
2	Amperites type 1-A

R. F. Stages

1	Hammarlund Midline condenser .0005
1	Hammarlund SGT-23 coil
1	Hammarlund equalizor condenser
1	Hammarlund bakelite cap 10 in. long
2	Benjamin sockets
2	Amperites type 622 and type 1-A, 1 each
1	Durham fixed resistor 7500 ohms
1	Durham single resistor mounting
3	Electrad bypass condensers .5 mfd

The most daring and imaginative of all experimenters was certainly the Abbe Nollet. To amuse the French king he sent a discharge through 180 soldiers and later through a line of Carthusian monks 900 feet long. He electrified seeds, vegetables and animals, and noted the effect with painstaking accuracy.

"Faders" Need Accuracy

ONE of the most trying resistance applications is found in the "fader," a device which gradually reduces or increases the volume from a sound head or phonograph pickup employed in talking picture installations. It is essential that the resistance steps be arranged for the gradual as well as the uniform increase or decrease of volume, in order that the human ear will not detect the successive steps.

"The usual 'fader,' explains Francis C. Ehle, president of the International Resistance Company, is arranged with successive resistance values in logarithmic progression. That is to say, the resistance values do not go up in arithmetrical steps, such as 1, 2, 3 and so on, but rather in geometrical steps such as 1, 2, 4, 8 and so on. The resistance values must be quite accurate. With the geometrical progression, it is quite impossible for the human ear to detect the step-by-step increase or decrease of volume, while a uniform rate of increase or decrease is obtained as contrasted with uniform resistance steps which would not provide a corresponding volume change.

"Metallized resistors, quite similar to those employed in radio practice, are being extensively employed in 'faders.' The values must be quite accurate, and the resistors must be capable of carrying the load day in and day out without breakdowns," concludes Mr. Ehle.

Windings Finer Than Hair

"AS fine as a human hair," is a common figure of speech. It is intended to denote work of very delicate and accurate nature. Yet in the production of wire-wound volume controls as well as flat wire fixed resistors, it is often necessary to work with wires as fine as and even finer than human hair.

"The reason why we are in position to provide very high resistances in wire-wound units today," states John Mucher, president of the Clarostat Mfg. Co., "is because of the special allow wires now

(*Continued on page* 130)

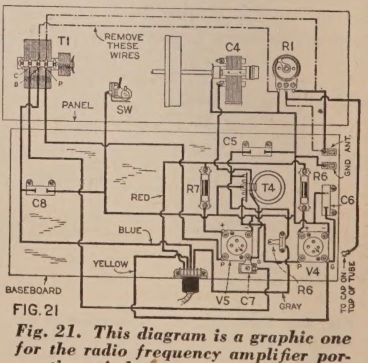
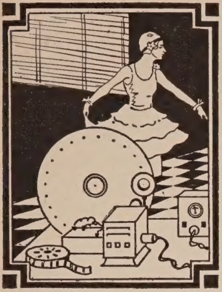


FIG. 21

Fig. 21. This diagram is a graphic one for the radio frequency amplifier portion of the completed receiver



PRACTICAL TELEVISION

DURING the summer there have been several factors which have retarded somewhat progress of television. Even though the public interest has remained fairly strong as indicated by replies to our March questionnaire, the uncertainty of the Federal Radio Commission's action with respect to television licenses and the width of the side band allowed has contributed a little to the delay on the part of companies in entering this field. The chief difficulty during the summer has been the fact that although many were willing to listen, the scarcity of good strong signals was such that wide spread reception was not possible.

However, now the Commission has licensed a number of stations on regular schedule and there are also a number given construction permits, many of whom will probably be on the air as this issue reaches the newsstands.

Agree on Framing

One of the interesting developments of the summer was the decision of the Television Standardization Committee of the RMA to consider 60 lines instead of 48 as being the standard, the 60 lines being for height and 72 lines for width, which would give greater detail. It was also felt that 20 frames per second more closely approximated the talkie speed with which there was an apparent intention to eventually tie up.

It will be observed that most of the radio communication companies who are doing television research work have adopted 60 by 72 by 20 as their standard, the first figure being the height, the second the width and the third the frames per second. However, there are still some of the stations that are transmitting 48 by 48 by 15, notably station W3XK of Jenkins at Washington, D. C. and Schenectady W2XCW running 24 by 24 by 20. According to the latest available figures, at this writing there are eight stations on regular schedule and eight stations on irregular experimental schedule or under construction. Among the last mentioned experimental stations probably three or more will be in operation by the time this magazine is on the streets.

Present Broadcast Schedules

The complete list is shown below, the first eight stations being on regular schedule and the remainder operate on irregular:—

Chicago, Ill.

W9XAA, Chicago Federation of Labor, 500 watts (approved for 1000 watts), 2000-2100 kc. or 145 m. 48 x 48 x 15. 9:00 to 11:00 a.m. Central Standard Time, daily except Sunday; movies, still pictures and living subjects.

Jersey City, N. J.

W2XCR, Jenkins Televsion Corporation, 5000 watts, 2100-2200 kc. or 139 m. 48 x 48 x 15. 2 to 3 p.m. Eastern Standard Time daily except Saturday and Sunday and 8 to 9 p.m., Monday, Wednesday and Friday.

Lexington, Mass.

W1XAY, Lexington Air Station, 500 watts (construction permit granted for 5000 watts), 2000-2100 kc. or 145 m. 48 x 48 x 15. Daily, 3 to 4 p.m. and Friday 7:30 to 8 p.m.

Mt. Beacon, Beacon, N. Y.

W2XBU, Harold E. Smith, 100 watts, 2000-2100 kc. or 145 m. 24 x 24 x 20. Transmits television programs, generally living subjects, daily 1 to 2 p.m. Eastern Standard Time.

New York, N. Y.

W2XBS, Radio Corporation of America, 250 watts (approved for 5000 watts) 2000-2100 kc. or 145 m., 60 x 72 x 20. Announcement cards, views and living subjects. Daily (including Sunday), 6 to 10 p.m. Eastern Standard Time.

Pittsburgh, Pa.

W8XAV, Westinghouse Electric and Manufacturing Co., 20,000 watts, 2000-2100 kc. or 145 m., 2100-2200 kc. or 139 m. and 2750-2850 kc. or 107 m. 60 x 72 x 20. Transmitting television programs, generally motion picture films, Monday, Wednesday and Friday, 5:10 to 6 p.m., Eastern Standard Time.

Schenectady, N. Y.

W2XCW, General Electric Co., 20,000 watts, 2100-2200 kc. or 139 m. 24 x 24 x 20. Sunday 10:45 to 11:15 p.m., Tuesday, 12 to 12:30 p.m., Tuesday, Wednesday and Friday, 1:30 to 2 p.m., Eastern Standard Time.

Washington, D. C.

W3XK, C. Francis Jenkins, 1500 watts 2000-2100 kc. or 145 m. and 2850-2950 kc. or 103 m. 48 x 48 x 15. Daily 8 to 9 p.m., Eastern Standard Time, Radiomovies.

Brooklyn, N. Y.

W2XCL, Pilot Electric Co., 250 watts, 2000-2100 kc. or 145 m. and 2750-2850 kc. or 107 m. Construction permit.

Chicago, Ill.

W9XAG, Aero-Products, Inc., 5000 watts, 2100-2200 kc. or 139 m. Construction permit.

Chicago, Ill.

W9XR, Great Lakes Broadcasting Co., 500 watts, 2850-2950 kc. or 103 m. 24 x 24 x 15.

Newark, N. J.

W2XBA, WAAM, Inc., 50 watts, 2750-2850 kc. or 107 m.

New York, N. Y.

W2XCP, Freed Eisemann Radio Corp., 2000 watts, 2000-2100 kc. or 145 m. and 2850-2950 kc. or 103 m.

Oakland, Calif.

W6XN, General Electric Co., 10,000 watts, 2000-2100 kc. or 145 m.

Springfield, Mass.

W1XAE, Westinghouse Electric and Manufacturing Co., 20,000 watts, 2000-2100 kc. or 145 m.

Winter Park, Fla.

W4XE, William Justis Lee, 2000 watts, 2000-2100 kc. or 145 m.

Digest of Science

Radio Finds Buried Treasures

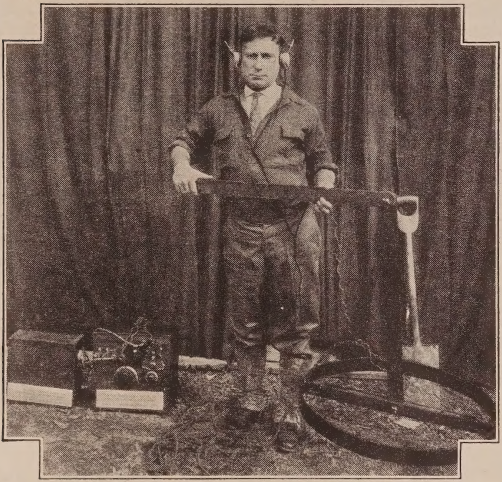


Photo by Wide World

G. O. Maher of Baton Rouge, La., is shown above holding what he describes as a ground radio machine for locating buried gold, silver and other non-magnetic metals. The device consists of a loop connected to the apparatus shown on the ground at the left. The loop may be carried by the operator, who wears a pair of head phones. According to Mr. Maher, the trained operator can determine the different sounds given by metals when in the field of the exploring loop. It is stated that a valuable metal may be detected just as deep as any reasonable person is apt to dig to bury such things in the beginning

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Coins Located by Loop

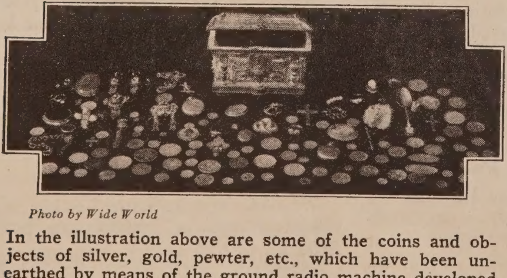

Photo by Wide World

In the illustration above are some of the coins and objects of silver, gold, pewter, etc., which have been unearthed by means of the ground radio machine developed by G. O. Maher of Baton Rouge, La. According to the operator of the machine, several of the coins so unearthed are over 200 years old and it is believed they have been buried at least 100 years

Tech Students Learn Radio

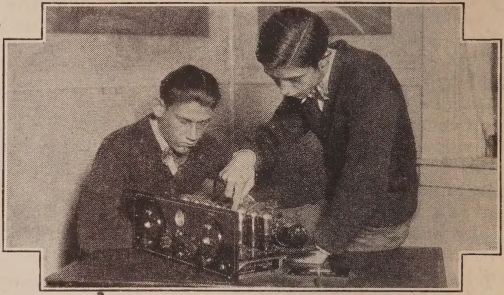

Photo by Wide World

The Lane Tech radio class have their own broadcasting station, WTLS, conducted by members of the class. Left to right: Wm. F. Loebel, Jr., learns a few things about radio from Harry C. Rowe, Jr., national champion radio builder of 1926

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Hunting Radio Interference Source

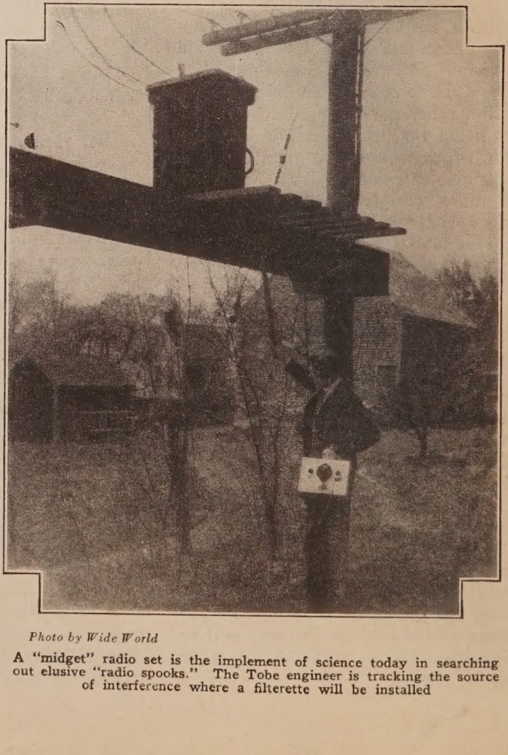

Photo by Wide World

A "midget" radio set is the implement of science today in searching out elusive "radio spooks." The Tobe engineer is tracking the source of interference where a filterette will be installed

Chinese Out-Talk Americans

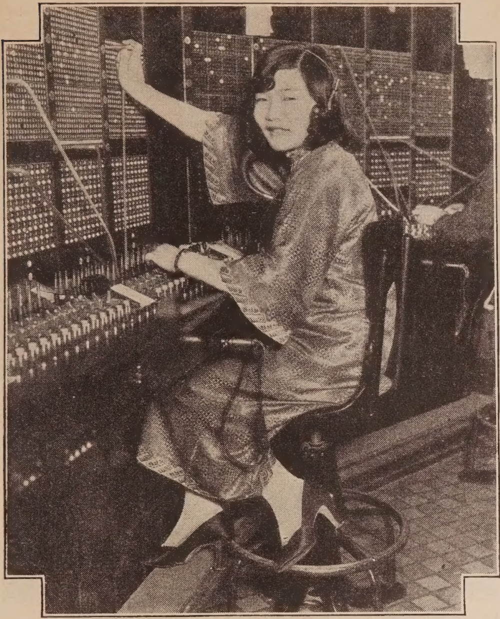

Photo by Wide World

The Chinese, the second most backward telephone nation, coming to America, out-talks the Americans two to one. In Chinatown, San Francisco, they make eight calls a day per phone, while San Francisco itself averages four daily

New Shockproof X-Ray Apparatus

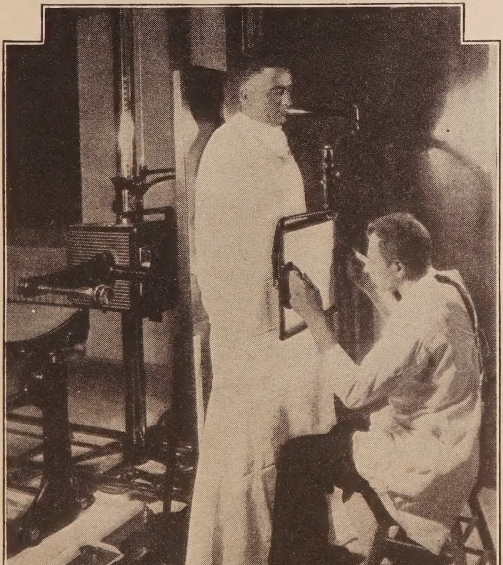

Photo by Wide World

A new X-Ray apparatus completely insulated in oil and with all overhead high voltage wires eliminated has been installed in the Neurological Institute in New York City by the Victor X-Ray Corp. Besides being shockproof, the new device can be used from any angle in X-raying the patient's body without moving the patient, an invaluable aid when severely injured patients are being X-rayed

Learn Secrets of Racer's Heart

Photo by Wide World

Testing the heart by light ray to determine pathological condition of the thoroughbred. New method of determining soundness of heart and fitness for racing. Yearlings to be tested for congenital abnormalities and other heart disorders. This device is the invention of Dr. T. G. Donovan of The Thoroughbred Institute

Woman Passes New Radio Exams

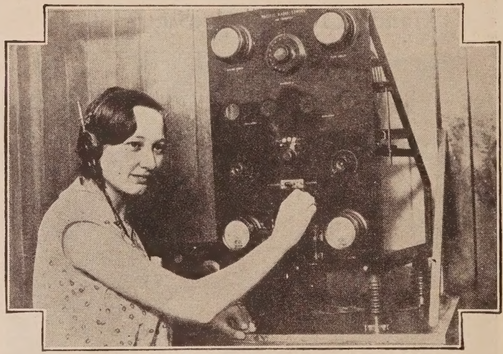

Photo by Wide World

Mrs. Charlotte Frances Simpson of San Francisco, Calif., the first woman to successfully pass the new government radio examinations as a commercial wireless operator of the second class. As soon as she completes another course at the radio school, Mrs. Simpson plans to secure employment in a broadcasting station as technician

Carries His Radio in Auto

Photo by Wide World

A. S. Brown, Jr., of Salem, Mass., with his new radio equipped automobile which will bring broadcasts to the occupants of car while it is rolling over the road and drown out the noise of the engine. The new radio is fitted into the dashboard in front of the operator and antennae will run through the inside of the roof of the car. A special apparatus has been manufactured to cap the spark plugs so that there will be no interruption to the reception while the motor is running. It can be installed in any of the more expensive types of motor cars and the prices range from $150.00 up

Music While You Motor

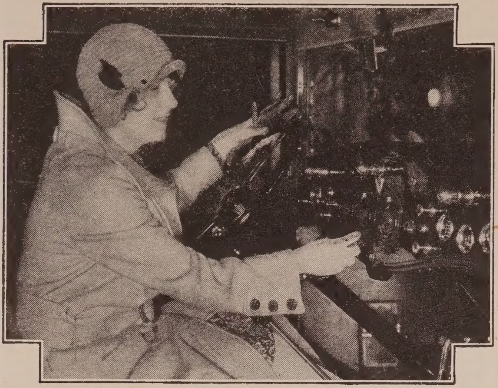

Photo by Wide World

Difficulties standing in the way of operating a radio set without interference in a running automobile have been surmounted. The auto-radio is a six tube six volt radio receiver completely enclosed

Handles 100 "Quotes" a Minute

Photo by Wide World

This new device is operated from a downtown transmitting station from which point electrical impulses are transmitted by wire to brokers' offices and posted with a speed equal to that of the new fast New York Stock Exchange tickers. The board will register 100 quotations a minute

Designs Triple Use Radio Set

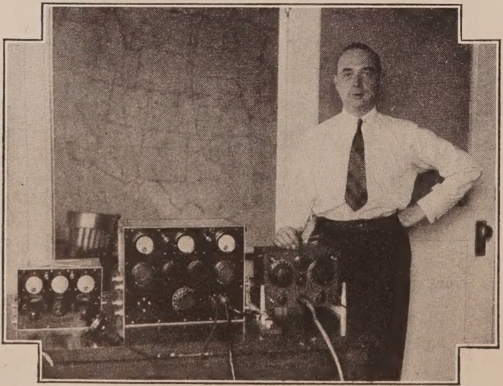

Photo by Wide World

Marcel Minguet, French radio engineer and wireless expert, who has devised an apparatus that can be used to telephone, both sending and receiving at the same time, and also be used for telegraphy

Telelux Operates by Light Beam

Photo by Wide World

Telelux, brother of the famed Televox, latest mechanical servant which is directed through the medium of light beam rather than by sound, as is the case of Televox, shown here stripped down to its vital organs.

Automatically Shows Wind Direction

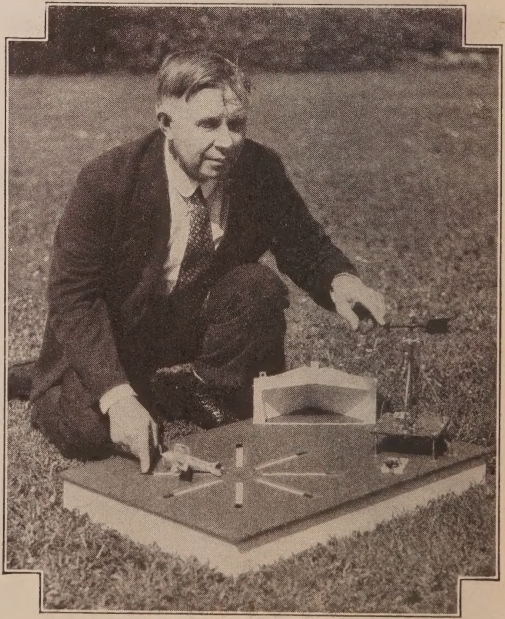

Photo by Wide World

R. C. Jackson, Oakland, Calif., with his model of his invention to show aviators the wind direction. Trenches are wired separately to a rotary switch driven by a wind vane. This vane switches current and light into the trench toward the wind, illuminating it and telling the night-flying aviator the wind's direction

Dragon Kite Will Lift Man

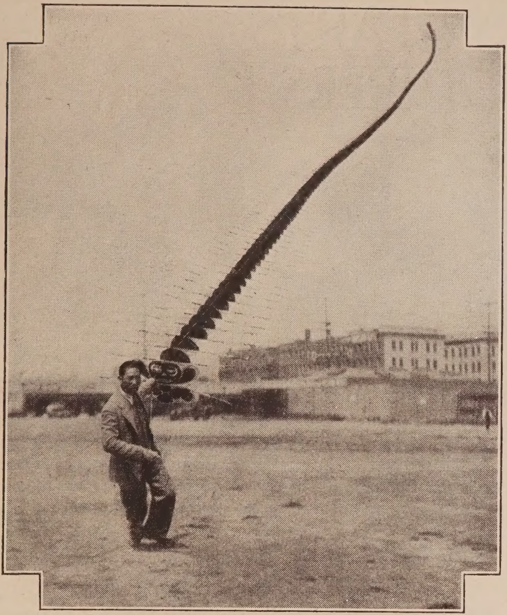

Photo by Wide World

Lee Shaw, young Los Angeles Chinese, who is known as the world's champion kite builder, exhibits his "Dragon Kite," which is 240 feet long when extended in the air and can easly lift a man

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Greatest Man-Made Lightning Flash

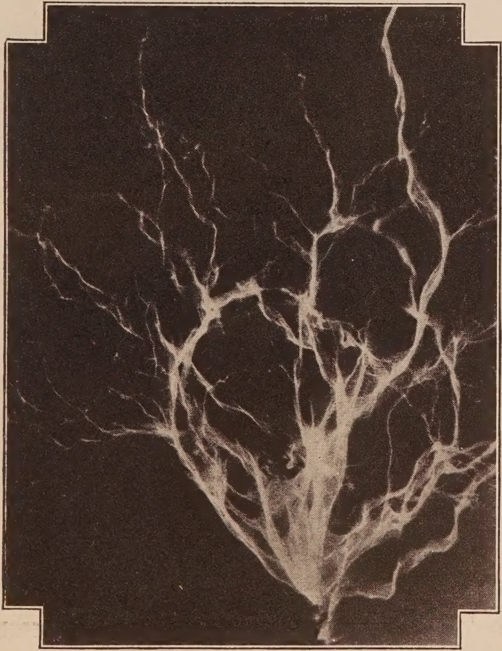


Photo by Wide World

What is said to be the greatest voltage ever produced commercially, 3,000,000 volts, capable of commercial application, controllable, and of deadly possibilities in warfare, was generated in San Francisco by John T. Martin, Seattle and San Francisco mining man and scientist. The voltage exceeds by 1,000,000 units the previous record. Photo shows the ball of power as it left the terminal, making a 13-foot jump

Test Girders for Zep Construction

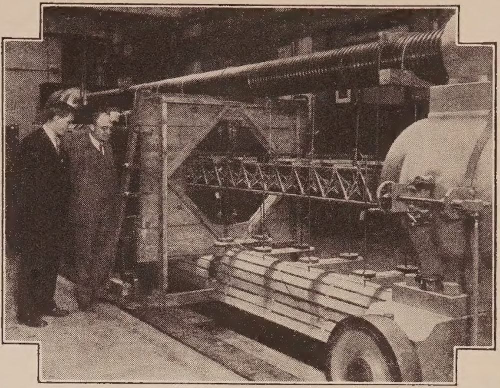


Photo by Wide World

At the request of the Bureau of Aeronautics of the Navy Department, the Bureau of Standards is making a series of tests on samples of the girders for the new Navy 6,500,000 cubic foot airships

Raises Armadillos as a Business

Photo by Wide World

Photo shows Charles Apelt, who specializes in the raising of armadillos. He is shown here with a mother and her four young ones. An interesting feature of armadillo families is the mother always has four young ones which are either all males or females

Device Registers Voice Waves Through Mike

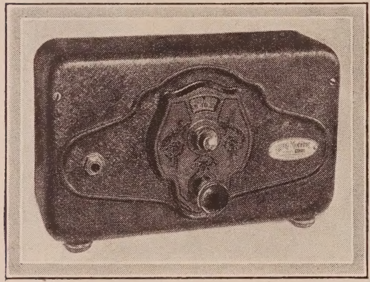
Photo by Wide World

This device records electric waves and registers voice waves when sent through a microphone

WITH THE ACCESSORY & PARTS MANUFACTURERS

Aero Markets Monitor for the Amateur and Listener

DESIGNED originally for the transmitting amateur, the "Listening Monitor" recently announced by Aero Products, Inc., 4611 E. Ravenswood Ave., Chicago, Illinois, also has some broadcast applications which might be interesting for those who are using adapters plugged into their broadcast sets in order to pick up programs on the short waves. When used for broadcast purposes on the short waves, it may be employed to simulate a distant transmitter and by means of the signal log the adapter for future reference.



Transmitting amateur may use the Aero Listening Monitor illustrated here as a means of checking the purity of his emitted wave

However its prime use is intended as a listening device for the transmitting amateur who may not only determine the nature of his emitted signal but its wavelength as well. Such a device is especially desirable when the amateur is using rectified a. c. that is incompletely filtered and which thereby causes some interference in the neighborhood.

The Aero "Listening Monitor" is a completely shielded unit including filament and B supply and operates with 199 type of tube. As shown in the illustration accompanying this description, it is contained in a black metal cabinet 9 in. long by 5½ in. high and 2½ in. deep. It employs a stable circuit and delivers a signal intensity, in the parlance of the amateurs, of about R4 or 5. The battery supply is thoroughly shielded from the r. f. Three coils are supplied with the Monitor which is merchandised including dry batteries but without tube.

Triad Cuts Down Breakage by Using Triangular Box

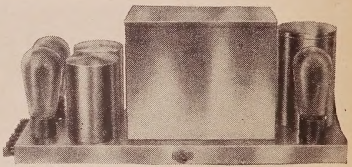
THE Triad Tube Company of Pawtucket, R. I., have found there is less damage to their radio tubes since the adoption of their triangular shaped tube box. Tests conducted over a period of weeks showed there was but 2 per cent damage in this type of packing as compared with 18 per cent with the usual type of box. The reason, according to Triad engineers, is that there are three ways the tube can move in the triangular box before it hits anything solid.

Mississippi Valley Radio Co. has 245 Push-Pull Amplifier

IN the accompanying illustration is shown a likeness of the Braxton King 245 push-pull amplifier pack recently announced by the Mississippi Valley Radio Co., Inc., 1914 Pine Street, St. Louis, Mo.

The amplifier is designed for use of 245 tubes in push-pull delivering 4.8 watts of undistorted output. The power supply delivers 250 volts to the plates of the two 245 tubes and also supplies sufficient intermediate voltage for the operation of a receiver. All voltages are fixed at the correct value and no adjustments are necessary. In addition to the filament winding for the 245's and the 280 rectifier tube, a separate 2½ volt filament winding is provided to handle six 224 or 227 tubes.

This photograph shows the 245 Push-Pull Amplifier Pack announced by the Mississippi Valley Radio Co.



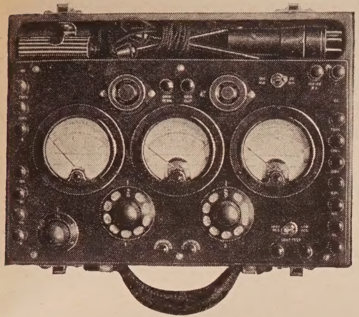
The filter circuit consists of two chokes. The first choke has an inductance of 7 henrys at 105 mils and the second an inductance of 20 henrys at 40 mils. The condenser used in the filter is of the Mershon type having a total capacity of 24 mfd.

The matched input and output transformers are mounted on the pack and are designed for use with 245 tubes. The entire pack is mounted on a highly finished pressed steel frame with protective shields over all the units.

Weston Designs New Set Tester for Service Men

SERVICE and repair men will be interested in the 547 radio set tester designed by the Weston Electrical Instrument Corp., Newark, N. J., a photograph of which is included with the description of the new item.

The model 547 is contained in a handsome rugged bakelite case provided with a carrying handle and a compartment for housing the set accessories and a few small tools. It has a removable snap-on cover. The overall size is 12⅜ in. by 9 in.



This photograph illustrates the Model 547 A. C.-D. C. Tester being marketed by the Weston Electrical Instrument Corp.

by 3¾ in. and the weight is approximately 10 pounds. The panel on which the instruments are and mounted is of moulded bakelite as well as the instrument cases, switches, binding posts, test sockets and test plug.

The instrument equipment consists of three 3¼ in. diameter Weston models, and 8 range d. c. model for 750, 250, 100, 50, 10, 5 volts, 100, 5 milliamperes; double range d. c. model 301 for 100, 20 milliamperes and a 5 range a. c. model 476 for 750, 150, 16, 8 and 4 volts.

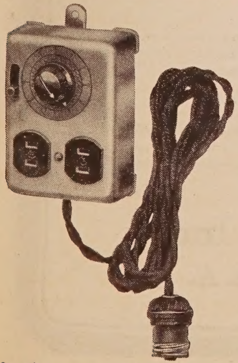
All ranges with the exception of the 750, 150 a. c. voltage ranges are made available by means of three rotary switches at the tester block which is permanently attached to the set by a flexible cable. All voltages and the 100, 20 milliampere ranges and also brought out the binding posts for use in external tests using flexible leads provided with the set.

Two sockets are provided on the panel, a UX and a UY. The tester plug has four prongs and an adapter is provided to change it to a five prong plug. All voltages and the 100, 20 milliampere ranges are brought out the binding posts. The d. c. voltage and current ranges are brought to binding posts at the right and the a. c. ranges to binding posts at the left. Two binding posts and a 4½ volt C battery are provided for use in making continuity tests with either a high or a low resistance voltmeter (1000 or 100 ohms per volt). The resistance is changed by means of the toggle switch.

Simultaneous readings can be made of the heater voltages on the a. c. voltmeter and the plate current on the milliammeter, while plate, grid bias, cathode or screen voltages or the gird, screen or rectifier currents are being measured on the d. c. volt milliammeter.

Sentinel Time Switch Is Produced by X-L Radio Laboratories

As the radio industry progresses and there is a greater distribution of radio sets among the public, it is becoming more noticeable that greatest interest centers on the automatic features of set operation. This is particularly true in the case of the a. c. set which may be turned on by the simple snap of the switch. However, there has been some demand for a device which will turn off the radio receiver at the end of a predetermined period. In this connection it is interesting to note that the X-L Radio Laboratories of Chicago, Ill., have begun the merchandising of the X-L Sentinel time switch, which is a practical device designed to shut off a radio receiver after any predetermined length of time. It may be used with a. c. or d. c. sets or sets using A and B eliminators. It has a double socket outlet for a radio receiver and reading lamp, or A and B eliminators where used. The device does not require winding. It has a bypass switch for use with the receiver without the use of a time switch which is automatically shut off when the switch is set. The bypass switch cannot be set while the time switch is in operation. In addition to its radio applications it may also be used to decided advantage on small display and small neon signs.



This little device enables the forgetful radio fan to leave home without worrying whether his receiver is turned on or off since the X-L Sentinel Time Switch automatically opens the receiver circuit at the end of a predetermined length of time

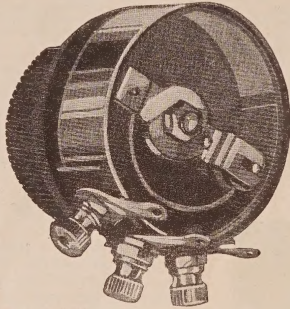
The time switch is shown in the photograph at the top of the unit with the dial. The bypass switch is illustrated at the left, while the two outlets are shown at the bottom.

For those who wish to receive a program for a definite length of time and then stop the receiver operation, the Sentinel time switch should be of interest.

Two New Type Volume Controls Produced by Polymet

THE Polymet Manufacturing Corporation has recently produced two unusual volume controls.

One is a metal shell type with a resistance element made of a special compound. Its action is extremely smooth, insures perfect contact at all times, is very durable, has a very low resistance "hop-off," and comes in a very small size (only 1½ in. outside diameter). This volume control can be made up in any required taper. Polymet engineers recommend this for use when resistances of more than 5000 ohms are required.



The second new type of Polymet volume control is a wire wound type in a ba
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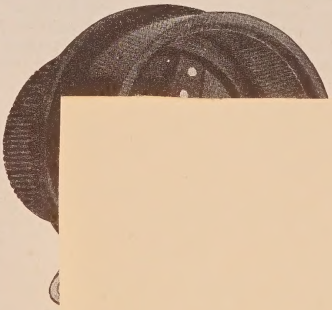
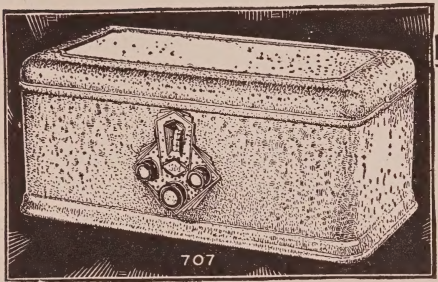


SM

New S-M Custom Receiver Designs Shatter All Records

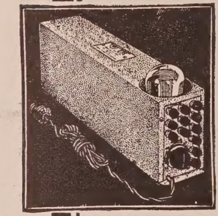
THEY'RE here—new 1930 designs by S-M which show results far exceeding—no matter how you measure them—the best obtainable last year. That was to be expected—every fan knows that the latest S-M design is always the finest performer to be had in the price class. But this year caps the climax of all S-M engineering history—for the new designs of this year exhibit, in addition to this far better performance, a tremendous new feature: perfect convenience of operation. That includes not only all-electric operation, with built-in power supply, but straight single-dial control—with *no verniers.* By the use of the newly developed series of shielded r. f. coils there is attained a degree of selectivity never before achieved even with multiple controls or verniers. One control now takes care of all tuning, another gives absolute control of volume—and the only other control is an off-on switch!



Now the setbuilder can, in truth, have every basic advantage of a receiver built to the latest design from standard parts—and yet, combined with it, all the convenience of factory-built sets, and all the cabinet beauty of the finest furniture.

The 707 Table-Model Shielding Cabinet, shown above, houses either the new 722 Band-Selector Seven or the 735 Round-the-World Six—or its battery-operated counterpart, the 735DC. The 707 is beautifully finished in crystalline brown with gold panel on the removable top. Price is only $7.75. For those who prefer full console cabinets, there are three splendid designs made especially to fit perfectly any of the S-M receivers described in this section. For description of these, see advertisement of I. A. Lund Corporation, page 108.

Smooth Unfailing Power From S-M Units



The setbuilder looking for a power supply that *will not fail* and *will supply smooth current* finds his desires satisfied in S-M power units. Built with that care that makes S-M a stamp of quality wherever found, designed to meet all the requirements of superlative service, S-M units naturally lead the field.

To turn the last stage of your receiver into a power stage using a 210 or 250 tube through the use of an adapter furnished with the wired unit, the 675ABC Power Supply will furnish 425, 135, 90, 22 and variable 22-90 B voltage to receiver, with C voltage, and A power at 1.5 volts, 4 amperes; 2.25 volts, 4 amperes—also 7.5 volts for the power tube filament. Operates from any 105 to 120 volt 50-60 cycle a. c. socket. Tube required: 1—'81. Price, wired, in handsome case 3$\frac{5}{16}$" by 5$\frac{1}{4}$" by 17", less tubes, $37.80. Component parts total $32.97.

Splendidly equipped to handle the new '45 and '24, and '27 and '26 tubes as well, the 669 Unit will supply current to sets having up to 10 tubes. Fixed B voltages of 67, 180, and 220 volts at 100 m. a., C voltages and A power at 1.5 volts, 4 amperes; 2.25 volts, 3 amperes; 2.25 volts, 6 amperes. Handling as it does all modern tubes, the 669 will be your logical choice for power supply. Tube required: 1—'80. Operates from any 105-120 volt 50-60 cycle a. c. light socket. Price, wired, in handsome crackle-finish case 13" by 3$\frac{1}{2}$" by 5$\frac{5}{16}$", less tube, $28.30. Component parts total $23.08.

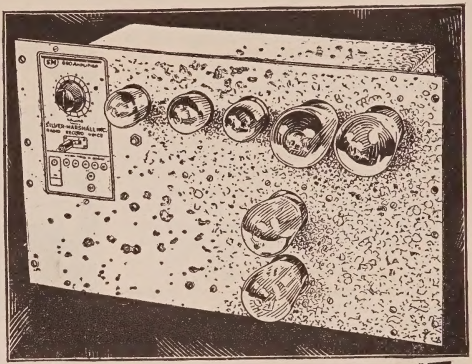
Over 3,000 Authorized S-M Service Stations cover the United States and Canada. Many are profiting handsomely! Write us for the address of the nearest one if you wish a custom-built set: setbuilders write us regarding a franchise in your territory.

"THE RADIOBUILDER" for July gave advance details of the S-M receivers shown on these pages—"THE RADIOBUILDER" has the news on S-M laboratory developments *first.* Hints on operating and building are in every issue—use the coupon!

SILVER-MARSHALL, Inc.

6413 West 65th St., Chicago, U. S. A.

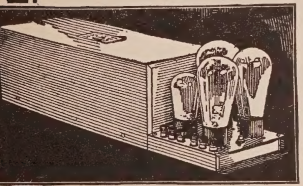
Finest S-M Tone Quality in Light-Socket Amplifiers and Dynamic Speakers



S-M 690 For Big Volume

Filling a long felt want because of its ability to cover large groups of people, both indoors and out, the 690 super-power all-electric amplifier is unique in its low-frequency amplification with negligible value of a. c. hum, attained without suppressing bass notes. At the same time, all the high-frequencies so necessary to perfect speech articulation are preserved—faithful reproduction throughout.

Simple to install and simple to operate; perfect control of volume; quick and easy switching to radio, phonograph, or voice. Three stages—two of them push-pull, the last using '50 tubes—give an output of about 15 watts—sufficient to operate *160 magnetic or 16 dynamic speakers.* The amplifier is mounted on a crystalline black panel, and parts are protected by a metal case. The S-M 690, at $147.00 net, has come to be the standard of value for 250-push-pull amplifiers. Tubes required: 1—'27, 2—'26, 2—'50, 2—'81. The 69025, similar but for 25 cycles, $172.00, less tubes. 691, at same price as 690, is for record pickup only, but has adjustable bass response.



S-M 679—a Powerful 250-Tube Amplifier at a New Low Price

Genuine S-M Clough-system two-stage amplification, up to the full power-capacity of a '50 tube, is now available at much reduced cost in the 679 amplifier. Will operate directly from detector output of any standard radio set or phonograph pickup, reaching up to 2000 people indoors, or 500 outdoors. Tubes required: 1—'26, 1—'50, 2—'81. Price, completely wired, less tubes, $62.50.

678PD Phonograph or Radio Amplifier

S-M 678PD phonograph or radio two-stage amplifier, though not quite so powerful, will supply full power to one or two dynamic speakers, furnishing also to one of them the field exciting current. Tubes required: 1—'26, 1—'81, 1—'50. Completely wired, less tubes, $47.40 net; component parts total $39.00.

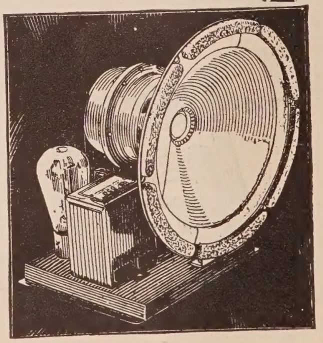
Several of our co-operating distributors, whose announcements directly follow, join us in presenting a descriptive summary of many of the outstanding values to be found in the new S-M line.

SILVER-MARSHALL, INC.

6413 W. 65th Street Chicago, U.S.A.

S-M Speakers Kill That "Drummy Tone"

Powerful reproduction with rich, vibrant, life-like tone quality, crystal-clear in both "highs" and "lows"—that is what you will get from S-M dynamic speakers. Practically no hum may be found in the S-M 850 (a.c.), where a 300 volt center-tapped transformer, with an '80 tube, converts a. c. to d. c. of the proper voltage, filtered by a condenser and the speaker field winding. The result is a smooth flow of filtered d. c. and obviates all necessity for a bucking coil, such a coil being prone to weaken low notes also.

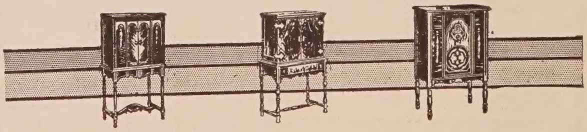


Both speakers are equipped with a universal output transformer, with taps allowing them to be fed from push-pull or single audio amplifiers, using 171A, 210, 245, or 250 type tubes. These unique features render the S-M speakers, while not low-priced, by far the best buy for the set-builder seeking the finest possible quality.

S-M 850 (a.c.) requiring one '80 tube, is only $35.10, with mounting base, less tube.

851 (d. c.) less base and power supply (requires 90—120 volts d. c.), $29.10.

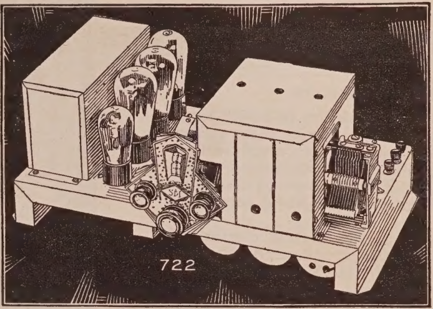
These Beautiful Consoles are Ready to House Your New S-M Receiver



Full description will be found on page 108, as given by the **I. A. Lund** Corporation, one of America's leading radio furniture manufacturers, with whom arrangements have been made to supply these beautiful cabinets, each one perfectly adapted to house any of the new S-M receivers—722, 735, 735DC, or 712 (with 677 amplifier). Ask your regular supplier about them.

SM

Screen-Grid Power Detection in New S-M Band-Selector Seven



Western Radio Manufacturing Co. is proud to present, in conjunction with Silver-Marshall, an all-electric set which, built from standard parts, will far exceed in actual performance any receiver or kit ever before available at any comparable price—and yet which embodies at the same time every important feature of convenience now obtainable in the best factory-built receivers. No engineers in the world know better how to bring out the full potentialities of the marvelous new 224-type a. c. screen-grid tubes than do the S-M laboratories. Into the 722 they have built *three* of these '24 tubes—two in r. f. stages and one as a power detector—*five times as good* in detection as the best heater tubes having no screen grid. There are in all *four tuned circuits* operated by the single illuminated drum dial (with no verniers); the first two form a band selector which delivers into the first r. f. tube only the signal to which the receiver is tuned—its tone purity preserved by a flat-top curve, but with skirts dropping off almost vertically—evidenced by the startling suddenness with which the volume from a strong local station drops off to zero as the tuning dial is turned slightly.

The decidedly higher amplification obtained in the screen-grid power detector makes it possible to use, in the first audio stage, a resistance coupler of extremely uniform frequency characteristic, and this stage, feeding into the push-pull output stage (using two '45 type tubes) provides marvelously perfect tone fidelity.

While the S-M 851 is exactly suited to this receiver, any other high-inductance 90-120 volt d. c. speaker of modern type may be used as well; speaker field excitation is provided from the receiver itself. Tubes required are: 3—'24, 1—'27, 2—'45, 1—'80. Although the ABC power unit is built in and forms an integral part of the S-M 722, the complete assembly measures only 18⅜ x 9½", and the cost is scarcely higher than that of the famous S-M 720 and 720AC screen-grid sixes of last year which required separate power supply.

Completely wired, less tubes and cabinet, Western Radio Manufacturing Co. offers the S-M 722 at $74.75 net to the trade. Our own specially packed parts, following exactly the published list of parts as used by Silver-Marshall in building this receiver, total only $52.90 net.

The beautiful S-M 707 table cabinet, in brown and gold crackle-finish, as described in their advertisement on page 104, we heartily recommend at $7.75 net.

At Last! An *All-Electric* Short-Wave Set

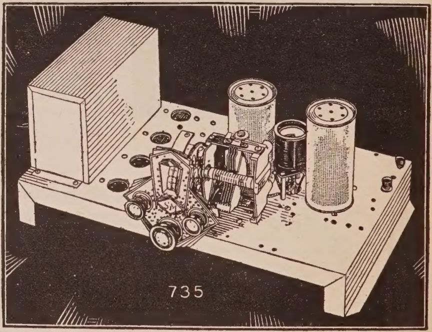
WESTRAD
Super Dynamic Speaker
Push-Pull Audio
Style Console
$64.75
WESTERN RADIO

In the 735 "Round-the-World Six", Western Radio Manufacturing Co. and the Silver-Marshall laboratories present *the* superlative short-wave receiver—an *all-electric screen-grid* set covering the bands from 16.6 to 200 meters—and bringing in stations anywhere in that range, in a way that will be a revelation to users of any previously available short-wave receiver.

The *first* a. c. short-wave receiver on the American market, the 735 is easily *first in performance* as well. Newly-designed plug-in coils, a regenerative power detector, a screen-grid r. f. stage, a typically excellent S-M audio amplifier, *built-in* power unit—all these combine with other features to present astounding quality in a remarkably inexpensive and flexible receiver.

The addition of two extra coils (131P and 131Q, costing together only $1.65) cover the broadcast bands, and make the 735 an all-wave receiver. S-M 735—bringing with it all the thrills of short-wave reception—costs, less tubes and cabinet but completely wired, only $64.90. Our own specially packed parts, following exactly the published list of parts used by Silver-Marshall, total only $44.90 net. Tubes required: 1—'24, 2—'27, 2—'45, 1—'80.

735DC, for battery use, price $44.80, less tubes and cabinet. Tubes required: 1—'22, 4—'12A. Specially packed parts, $26.80. Either 735 or 735DC fits perfectly the 707 cabinet mentioned above.



Use the Coupon to Get Our Catalog

Largest Distributor of S-M Parts and Receivers

On all the S-M receivers and parts described in these pages, as well as on a wealth of other high grade radio sets and accessories, we are prepared to give immediate, speedy service. Use the coupon and get our new catalog describing our line.

Prices Subject to 2% Cash Discount.

Western Radio Mfg. Co.,
128 West Lake Street,
Dept. SM-9,
Chicago, Illinois.

Please send at once your new FREE catalog listing S-M parts and kits as well as many other highest-quality radio products.

Name ....

Address ....

Town and State ....

Western Radio Manufacturing Co.

The Big Friendly Radio House

128 West Lake Street Chicago, Illinois

SM

W. C. Braun Co., Official Wholesale Distributors, Offer

Super-Selectivity in The New S-M 712

Better Than The Sargent-Rayment!

Band-Selector, All-Electric, Single-Control

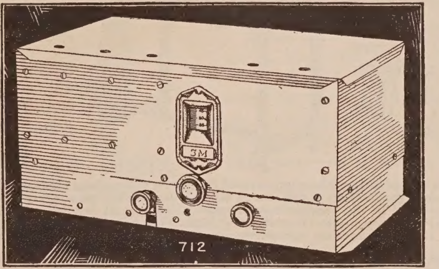
Silver-Marshall engineers, working in the finely equipped new S-M laboratory, tell us that they have produced a tuner even more selective than the amazingly selective Sargent-Rayment 710—one that tests several times as sensitive, and is moreover *all-electric* in operation and strictly *single-control.* New shielded coils, developed by intensive research, are the big factor in the elimination of the stage verniers of the 710.

Uses band-selector tuning between the antenna and the first of the three screen-grid radio frequency stages (a total of five circuits). The 712 not only has selectivity far outclassing anything hitherto obtainable, but the brilliant high notes are marvelously preserved by the band filter in a manner absolutely impossible without it.

Such sensitivity requires far more perfect shielding than ever before necessary, and this has been so perfected that *long distance reception* is possible with only a short indoor antenna—yet when that antenna is removed a dead silence results.

A tuner only, the 712 will feed properly into any power amplifier, but the 677 Amplifier, supplying the only two voltages required by the receiver—180-B and 2½-a. c.—is particularly recommended.

The 712 is supplied ready for use in a metal shielding cabinet 16½ inches wide, 9½ inches deep, and 7⅝ inches high. The symmetrical grouping of controls is placed 9⅛ inches from the left, as the 712 will usually be mounted in a console and center placing is therefore not necessary. Requires one '227 and three '224 type tubes. Component parts total $40.90. Price, as described, wired, in cabinet less tubes, $64.90.



Fourteen Points on the 712

1. Band-Selector Tuning
2. All-Electric Operation
3. Strictly Single Control—No Verniers
4. Three Stages Screen-Grid Amplification
5. Many Times as Sensitive as the Sargent-Rayment
6. Selectivity with Simplicity
7. Power Detection
8. Built of Standard Parts
9. Gives the Thrills of Distance
10. Most Complete Shielding Ever Attempted
11. Uses New Shielded S-M Coils
12. Five Tuned Circuits
13. Convenience Plus
14. Built by Silver-Marshall

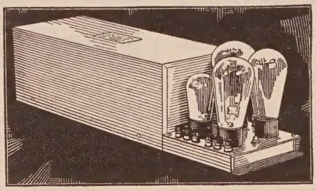
RAPID SERVICE ON ALL S-M PARTS

A complete stock of all receivers and parts illustrated on these pages, together with all parts of the receivers, is on hand ready for *immediate* shipment to fill dealers' requirements anywhere. Our central location and proximity to the S-M factories enables us to render exceptional service. Write on your letterhead or use the coupon below for a free copy of our catalog, and learn about our successful dealer plans.

Official Wholesale Distributors of S-M Products

An Ideal Amplifier For the 712!

That truly superb distortionless amplification, retaining both high and low notes to attain the tone that has helped make S-M famous, is here found better than ever before, and at a cost remarkably small. Particularly adapted to the 712, the S-M 677 is ideal wherever an output of up to 4½ watts, with top-notch tone quality, is required. A special input binding post provides an unusually high ratio, resulting in ideal amplification of phonograph input.



Clough-system audio amplification throughout—the first stage using a 227 tube, and a push-pull second stage using S-M transformers in connection with 245 tubes—gives this 677 Amplifier its powerful undistorted amplification. The power supply, using a 280, provides ample ABC current not only for the amplifier but also 180 volts B and 2½ volts A—sufficient for the S-M 712 or any tuner requiring like voltages. Tubes required: 1-'27, 2-'45, 1-'80. Component parts total $43.40. Price, wired, complete less tubes, $58.50 Net. (Same for 25 cycles $72.50.)

W. C. BRAUN COMPANY
Pioneers in Radio
560 W. Randolph St.
CHICAGO
ILLINOIS

W. C. BRAUN CO.
560 W. Randolph St., Chicago.

Dear Sirs: I am not receiving the W. C. Braun Co. Catalog regularly. Please put my name on your mailing list of set-builders and dealers, giving me the prices and information on S-M parts and other merchandise. My letterhead is attached.

Name..

St. & No..

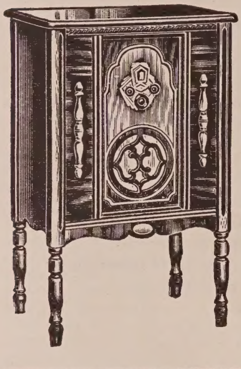
State.............................City................

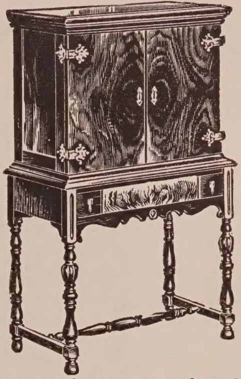
SM

Officially Recommended for S-M Receivers by Silver-Marshall

The Best in Radio—

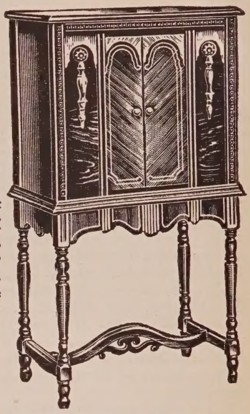
(Left)—This beautiful lowboy cabinet is provided with genuine walnut veneer top and side panels, and front side panels of high-lighted, fiddle-back mahogany, all beautifully and harmoniously finished. Overall, 38½" high, 24½" wide, and 15½" deep; set compartment, 9" by 19½" by 12½" deep; speaker compartment, 12" by 21" by 12½" deep. No. 211SM Cabinet, $18, *net*.





The Best in Cabinets—

(Right)—Top and sides of genuine walnut plywood, front side panels of walnut with Carpathian elm overlays, and other like overlays on the five-ply "V" matched African walnut sliding doors, contribute to the surpassing beauty of this highboy. Overall, 50½" high, 27½" wide, and 16½" deep; speaker compartment, 12" by 23" by 13½" deep; set compartment, 9" by 23" by 13½" deep. No. 217SM Cabinet, price, $30.00 net.



(Center)—For combination phonograph and radio use, this walnut cabinet with its butt-walnut full-folding doors is particularly excellent. A sliding drawer for phonograph turntable, pickup, and motor is provided in the speaker compartment, and special provision is made in the lower drawer for the S-M 677 Amplifier. Overall, 54½" high, 33¾" wide, and 18" deep; set compartment, 9" by 27½" by 12" deep; speaker compartment, 12" by 28½" by 13" deep. No. 229SM, price, $56.40 net.

Any of the above cabinets will take the S-M 712 and 677, 735, 722, or 735DC. If your jobber does not handle these special S-M cabinets, write us direct, enclosing 25% deposit if you wish the cabinets shipped C. O. D. (2% off for cash).

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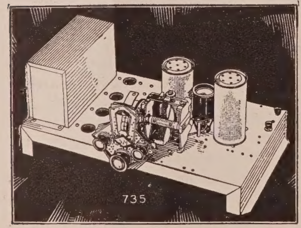

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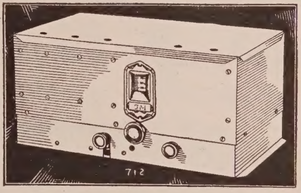

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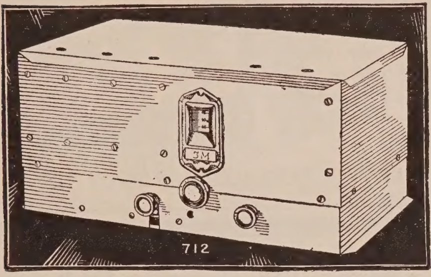

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2V-36157	735	Component parts of 735................	44.90	44.00
2V-36158	735DC	SHORT-WAVE RECEIVER (Wired, d.c.)	44.80	43.90
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V-16209	131P	Plug-In Coil (163-343 meters)............	.75	.73
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2V-3354	707	Cabinet (for 735, 735DC, and 722).......	7.75	7.60
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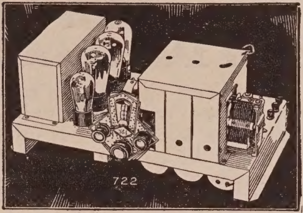

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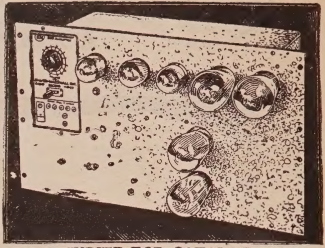

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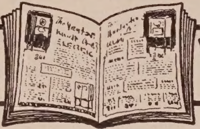

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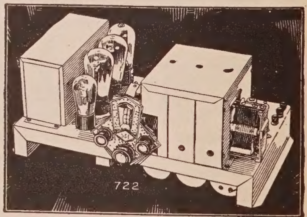

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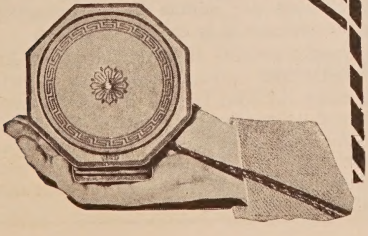

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T 504	1. Mfd.	1000	1 7/16" x 4 ½" x 4 ¾" high	2.75
T 505	2. Mfd.	1000	1 7/16" x 4 ½" x 4 ¾" high	5.25
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(*Continued from page* 53)

ing rapidly by the light beam will vary the amount of illumination entering the light-sensitive cell. Consequently, if a battery is applied across the photo-electric cell, the fluctuating light beam will change the electrical resistance of the photo-electric cell, producing electrical pulsations in the circuit corresponding with the changing light. That is to say, when a relatively large amount of light enters the photo-electric cell through a transparent section of the film a correspondingly large amount of current flows in the circuit; or, when a shaded or dark area passes by it bars the light of the light-sensitive cell, momentarily lowering the current value.

The photo-electric cell employed in the "Photophone" is coated inside with a spray of silver and caesium. A tiny quantity of inert gas is added to increase sensitivity through ionization. This light-sensitive cell is excited by 200 volts of direct current, supplied through winding of a 12-to-1 radio step-down transformer. The latter is mounted on the head of the sound reproducer together with the photo-electric cell. The pulsating current induced in the secondary winding of this transformer is fed through a cable to a so-called fader—a potentiometer employed for transferring the sound pick-up from one projector to another at the beginning and end of the motion-picture reel. This device may be remotely controlled from either projector and it affords a gradual change-over from zero to maximum volume.

The Photophone is thus comprised of the following arrangement—photo-electric cell, a step-down transformer, a cable connecting with the special potentiometer or so-called fader, a step-up transformer, and the amplifying stages. The amplifying circuit, for instance, consists of three stages of push-pull voltage amplification, employing UX-210 vacuum tubes, feeding an output stage of push-pull power of amplification through UX-250 or UX-845 electron tubes. The amplified signal passes through an output transformer into the electro-dynamic loud-speakers—an exclusive feature of the "Photophone" sound-reproducing system.

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The sound recorder consists of two main parts: An oscillograph galvanometer and optical system, and a meter-driven mechanism to carry the film from a standard camera magazine past the sound-light-recording device and back to the take-up magazine. An appropriate system of sprockets and guide rollers carries the film through the recorder and over a friction drum attached to a flywheel to keep the film traveling at constant speed.

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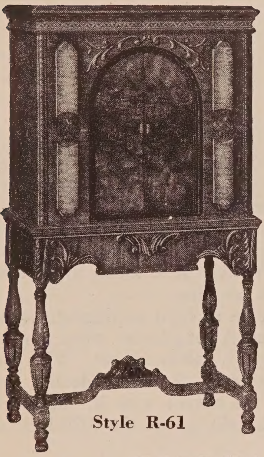

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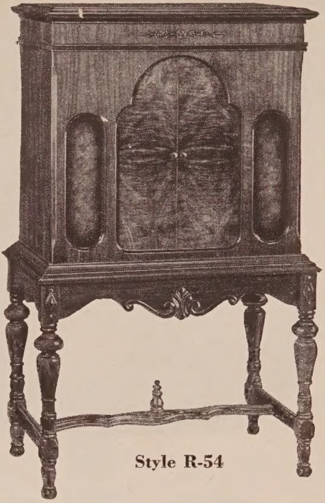

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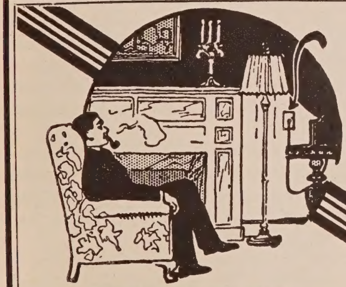

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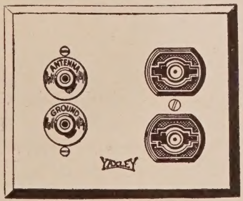

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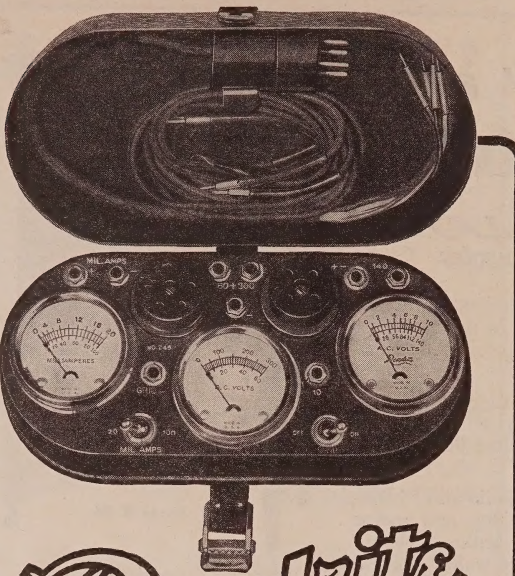

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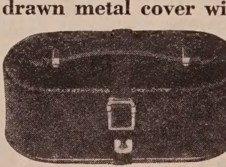

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The Photophone recording employs a condenser-microphone, which transforms sound energy into electrical energy. The minute electric current caused to flow in the microphone circuit when sound enters the microphone is amplified through two stages of amplification and is taken to the main recorder amplifier. This amplifier has a mixing panel for combining additional microphone circuits should more than one microphone be used. The resulting circuit feeds into the first stage of the main recording amplifier, and through four successive stages. The original microphone signal has been amplified 100,000,000 times and is then connected directly across the oscillograph galvanometer in the recorder. This galvanometer consists of a molybdenum wire loop, through which the amplified microphone-current circulates. A small mirror is cemented to this loop, and the loop is suspended in a magnetic field.

A lamp similar to the ordinary automobile headlight lamp furnishes the illumination for making the photographic record. Light from this lamp passes through a condenser lens and is focused on the galvanometer mirror, from which it is reflected through another condensing lens onto a slit .002 by .280 inches. The resultant slit of light passes through a projector lens, which optically reduces it to .0005 by .070 inches at the point where it strikes the film.

As a matter of fact, the beam of light impinging on the slit actually covers only half of it lengthwise when no microphone-current is applied to the galvanometer. With current flowing through the galvanometer, the molybdenum loop is set into vibration, carrying the mirror with it, and tracing a line of light the width of the slit across the .070-inch sound track of the film.

In the sound-track figure, the peaks extending across part of the sound track represent a lower volume of sound than those peaks covering the full width of the track. The fine lines indicate the higher frequencies; the heavier and thicker peaks are the lower frequencies. It will be noticed that many of the peaks are covered with fine, fringe-like extensions. These represent the overtones and give the reproduced sound the additional frequencies present in the original sound at the "mike."

In the two-film method of recording sound and picture, an identifying mark must be placed on each film simultaneously so that sound and picture can be matched (synchronized) when printing on one postive film.

Several marking methods are available. One is to have a person stand before the camera before and after every shot and bring together two sticks with a sharp impact. Both films then have a record of this—one in picture form, the other in a heavy impression on the sound track.

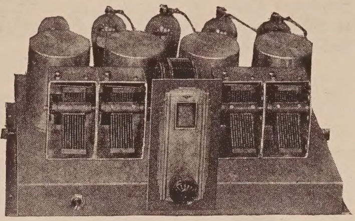
Another method employs electrically-operated markers in the camera and sound recorder. The camera has a small mazda lamp so placed that its light exposes the edge of the film outside the sprocket holes, leaving a black line after developing. The sound recorder marker is a shutter-operated device for controlling an auxiliary source of light. By operating the shutter through a magnet, this auxiliary light exposes a strip on the sound film adjacent to the sound track. Both the camera and sound recorder markers are simultaneously operated from a push button in the hands of the director.

The Photophone uses positive instead of negative film for sound recording. This is because the grain in positive film is considerably finer than in negative stock, reducing the amount of "ground noise" when the combined sound and picture positive is run through the projector. The value in using separate films for sound and picture lies in the fact that both can be developed separately to their proper densities. This is important because the amount of exposure of each film is different.

In combining the sound and picture films on one positive, the sound film is advanced fourteen and a half inches ahead of the picture. This is to compensate for the position of the Photophone sound pick-up aperture which is located below the

(Continued on page 116)

4 SCREEN-GRID TUBES
AND POWER-DETECTION!



The MB-29 bristles with new and ingenious features, for your convenience and pleasure.

Write us today for full information.

This magnificent tuner incorporates every feature of most advanced radio practice.

Four Screen-Grid Tubes, Band-Pass Tuning and Power-Detection give the maximum of distance, selectivity, tone and reproduction from the high-percentage-modulation broadcasts, now rapidly being adopted by all leading stations. Completely shielded aluminum chassis, precision matched coils, and latest NATIONAL Projector Dial, all make possible the construction of an A.C. Receiver which is the utmost in quality and appearance.

The NATIONAL Velvetone Amplifier Power-Supply is specially designed for use with the MB-29. Uses two UX-245's in push-pull, and is fitted with phonograph jack. This Amplifier is licensed under R. C. A. patents and sold fully wired and ready for use (less tubes).

Beautiful and specially priced consoles and tables are available for use with the MB-29 in popular combinations.

NATIONAL COMPANY, INC., Malden, Mass.
W. A. Ready, Pres.
Engineers and Manufacturers
Est. 1914

NATIONAL
SCREEN-GRID— MB-29

Radio Photograph Experiments

Wide World Photo

Capt. Ranger of the Radio Corporation of America experimenting with his wireless photography apparatus. The receiver is shown with some of the received "copy" coming through.

Electricity Detects Potato Disease

A possible new use for electricity in "plant hygiene" was discussed before the American Phytopathological Association by Walter Jones and Assistant Professor T. E. Rawlins of the University of California.

Prof. Rawlins pointed out that in studying the electrical conductivity of healthy tubers and of tubers containing the virus of the disease known as spindle-tuber, it was found that the juice of healthy tubers had a higher resistance than the juice of infected tubers.

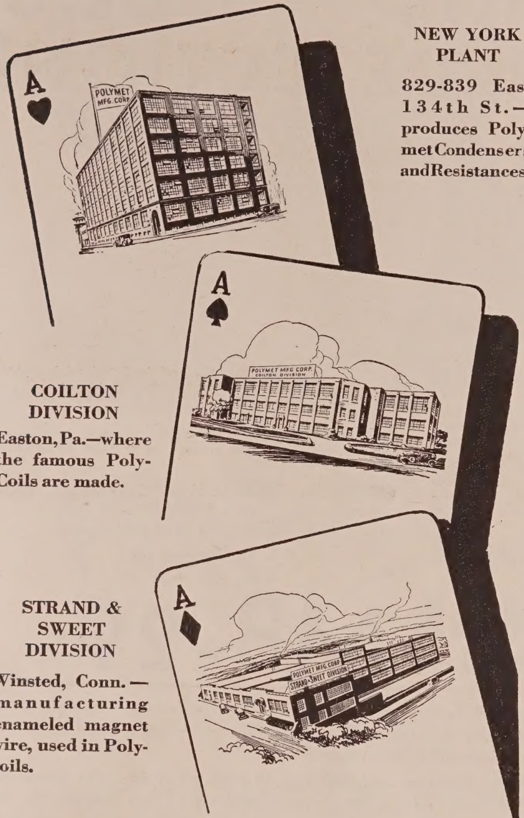
British Physicist Gets Shock from Omnibus

Charles Vernon Boys, eminent British physicist, was about to board an omnibus near his home on Victoria Street in London. As it came to a stop, he reached for the rail. When his hand came near the metal, he felt an unmistakable electric discharge from the rail to his hand, giving him a very noticeable shock.

Being a scientist, he did not pass it by as merely a curious happening. Instead he stopped to consider what the cause was. Also, as it was apparently a phenomenon that had never been observed before, he reported it to the scientific world through the pages of "Nature," leading scientific journal.

"In all cases where the omnibuses came along at a brisk pace and pulled up quickly I received a sharp prick from the spark," he said. "In one case a second application was rewarded by a second spark. It was at a time when the sun was shining down the street and all was as hot and dry as could well be. No doubt it was the scuffling of the rubber tires on the polished asphalt that gave rise to the electrification. In intensity, the shock, if such a term can be used, was two or three times as strong as that obtained after stroking a cat by the fire on a frosty night, when a visible spark may be obtained from the cat's nose."

THREE OF A KIND


A
A
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POLYMET MFG CORP
POLYMET MFG CORP COILTON DIVISION
POLYMET MFG CORP STRAND-SWEET DIVISION

NEW YORK PLANT

829-839 East 134th St.—produces Polymet Condensers and Resistances.

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Easton, Pa.—where the famous Poly-Coils are made.

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Winsted, Conn.—manufacturing enameled magnet wire, used in Poly-coils.

that beat everything!

The Three New Plants of

POLYMET

Here you see the great factories behind Polymet Products and the sets and packs you build.

Every factory is equipped with the very latest and most advanced machinery under the direction of expert engineers.

That's why we can safely recommend Polymet Products to give you the best results no matter what you're building—correct design, correct manufacture, and careful pre-testing of parts mean a great deal in your final result.

Write for the new Polymet catalogue

POLYMET MANUFACTURING CORPORATION

839-B East 134th Street New York City

POLYMET PRODUCTS

projector-scene aperture, a distance equivalent to fourteen and a half inches of film as it is threaded through the projector.

(Editor's note: The concluding installment of this absorbing history of the "Talkie" art will appear in a forthcoming number. Be sure to watch for it, because it gives worth while information for those who keep abreast of electrical and mechanical progress.)

Universal ABC Power Supply with Master Power Amplifier

(*Continued from page* 71)

ent stabilization.

The voltage-divider system is a new unit, completely wired and assembled ready for use. Most resistance values are variable, and of new design, using nickel-alloy wire wound on a threaded core. The entire unit made by Electrad is housed in a bakelite case ready for integral assembly. It is thoroughly scientific in design and absolutely fool-proof, a valuable feature.

It is well known that endless trouble may be encountered through the use of "B" power eliminators of inadequate design. An analysis invariably leads to one or more of the following:

(1) Poor regulation. This may be caused by scanty design of the power transformers, cheap filter construction and poor resistances. T_1, used in this unit, is rated at 200 watts and is scientifically designed for a power job; it is rugged and has a high factor of safety.

(2) Faulty filtration due to poor design of the filtering choke-condenser system, or skimpy units. Good choke-coils of generous proportions, and condensers designed for operation at high voltages, cost money. However, there seems to be a definite minimum, below which it is not possible to reduce either of these factors. Consequently, it is often discovered, in products of solely a competitive quality, that insufficient inductance or capacity has been used. Cases of this kind are easily detectable by the surplus of residual hum and miserable regulation characteristics.

(3) Resistance burnouts and breakdowns. All resistances should be of rugged design, easily adjustable wherever voltage control is required, and must operate noiselessly and keep their calibration under all operating conditions.

Figure 2 shows a master power-supply capable of excellent regulation and maximum filtration. There is no residual hum of any significance. The regulation is excellent because of the efficient functioning of the two 874 voltage regulator tubes. This unit will give endless service, the tubes being the only replacement necessary. The voltages may be varied by calibrated knobs to any value desired. Filament currents for all a. c. tubes are available from the special filament transformer T_2—No. 463. This transformer has an exclusive compensator-plug for controlling the filament voltages to compensate for light-socket voltage variations. This feature is unique inasmuch as it permits the a. c. tubes to receive proper filament voltages at all times under conditions of source variations at the power-mains. Full life of all tubes is thereby assured, an important factor in a. c. operation. Furthermore, any a. c. tubes can be supplied with its proper filament currents, as the different windings provide thorough flexibility of selection and supply.

The choke coils, No. 312, L_1 and L_2, are heavy duty coils of rugged design and will maintain an inductance of 30 henries under a load of 120 milliamperes. Combined with sufficient capacity to the negative lead, the rectifier output will be humless and uniform. Elimination of hum and residual noises at this point means absolute freedom of trouble at voltage taps.

Figure 4 gives the schematic diagram for the Symphonic master amplifier system.

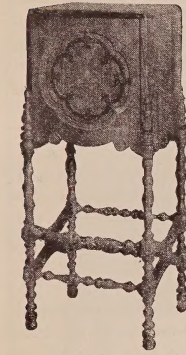
The incorporation of a three-stage audio amplifier will prove exceptional and advisable if precautions are taken to

(*Continued on page* 118)

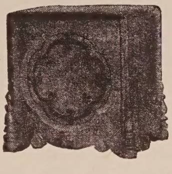
the NEW

WRIGHT-DE COSTER REPRODUCER

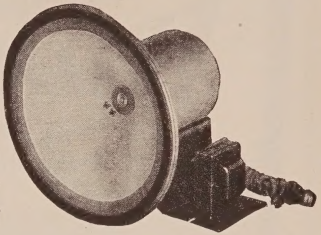
The Speaker of the year



"E" Cabinet
Small Console Model



"D" Cabinet
Table Model



NO HUM

Clear, distinct enunciation—no hum—Soft Mellow Music. Write Department—H for descriptive matter and address of nearest district sales office. If you are in a hurry for a sample speaker order one at the same time.

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MAIN OFFICE AND FACTORIES
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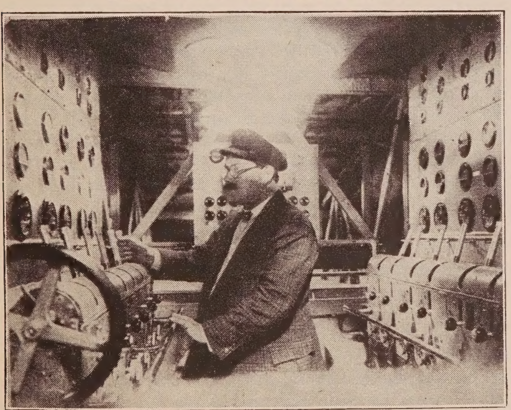
Interior of Dornier Plane



Wide World Photo

The mechanism of the great Dornier plane in which the engineer in charge with four mechanicians will operate the twelve motors of the ship

Egyptian Mummy Contains Pro-Vitamin D

The brain of an Egyptian mummy dating from about 500 A.D. has been examined by chemists and found to contain ergosterol, the parent substance of vitamin D. This news comes from Drs. H. King, Otto Rosenheim and T. A. Webster, working at the National Institute for Medical Research at London. They find that ergosterol is remarkably stable in animal tissues (brain, gallstones, blood, skin, eggs, etc.), although it is very unstable when separated from other substances. In the animal tissues it is protected by a closely related substance called cholesterol, which was originally thought to be pro-vitamin D.

Ergosterol has now been found in conjunction with cholesterol in a mummy brain which is about 1,400 years old. The brain was of Coptic origin, and was removed from one of the bodies found in tombs in Antinoe, Upper Egypt. No embalming process had been used, and the organs of the body were preserved in their original positions, but of course shrunk and mummified under the influence of the dry atmosphere of Egypt.

Don't Mind a Wetting in a Thunderstorm —It's Safer

If you are out in the open and a thunderstorm suddenly comes up, don't raise your umbrella to keep dry. Go to as low a place as possible, sit down, or even lie down. Then you may get soaked to the skin, but you will probably not be struck by lightning.

This is the advice of Dr. W. J. Humphreys, professor of meteorological physics of the U. S. Weather Bureau, given to Science Service in commenting on the recent deaths of three people of lightning on a Montreal golf course when their umbrella was struck.

"Personally, I would prefer the ducking to the risk of being killed," said Dr. Humphreys.

A low place is safer than the top of a hill, and the lower the person is, the safer he is. Nothing should be held above the head. A few years ago a man on a Washington golf course was killed when lightning struck his golf sticks held over his shoulder. If a person lies down on the ground, there will be little danger. It may be uncomfortable to be soaked, but the wetting is a further protection. Wet clothes are a pretty good conductor, so the lightning will be carried off, even if the person is struck.

It's More Than A
LIGHTNING ARRESTER
CORWICO
VULCAN
LIGHTNING ARRESTER
Also Dissipates Static Charges

PRICE $1.00

CORWICO
VULCAN
RADIO
LIGHTNING ARRESTER
$100

The Corwico Vulcan Lightning Arrester's protection against lightning damage to radio receivers is guaranteed by a $100 insurance pledge enclosed with each Arrester. The Vulcan Arrester is so constructed that it also dissipates accumulated static charges. Why take chances when you can have guaranteed lightning protection and better reception for only one dollar?

At Your Dealers or Direct Upon Receipt of Price

CORWICO ANTENNA KIT

PRICE $2.50

CORWICO
COMPLETE ANTENNA KIT
VULCAN
$100

This is the time of the year you should overhaul your radio to get ready for the new fall and winter programs. There is no part of a radio installation more important and conducive to clear and uninterrupted reception than the aerial lead-in wires, etc. At very little expense and within a few minutes time, you can have complete new aerial equipment. Buy the Corwico Antenna Kit No. 4. It contains everything necessary for a complete antenna equipment, including a Corwico Vulcan Lightning Arrester.

At Your Dealers or Direct Upon Receipt of Price

CORNISH WIRE CO.
30 Church St., New York

MAKERS OF
CORWICO BRAIDITE HOOK UP WIRE

carefully balance each unit to prevent feed-backs and control amplification. A little figuring will show that the usual practice of using a single stage of audio amplification between the detector output and the input transformer of the 210 or 250 push-pull stage tends to cause serious overloading.

With the advent of the new power tubes, such as the 210 or 250 type, the average fan demands a heavy, rich, tonal output with a magnificent reproduction of bass energy. The usual first-stage radio is not sufficient to feed a 210 or 250 amplifier.

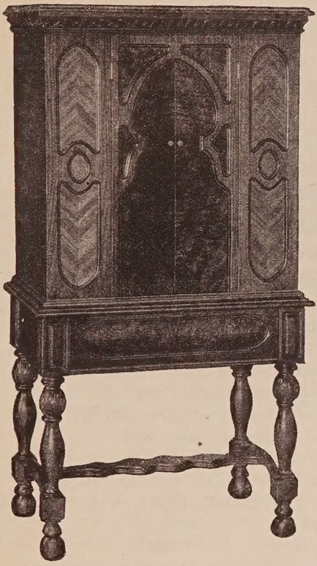
Let us see what the average output voltage is from a one-stage audio-amplifier. If we assume the detector output voltage to range between 0.1 and 0.5 volts, we would have 0.1 of a volt on weak stations and 0.5 or so on powerful local stations. As our amplifier should be powerful enough to properly amplify signal voltages as low as .1 volt input, let us select .3 volt as a fair average for our discussion. If a 201-A or 201-B tube is used for the first audio stage coupled by a 4 to 1 ratio transformer, this followed by the push-pull input transformer, of say, 3 to 1 ratio, the entire amplification of the system would be, allowing a transformer efficiency of 0.9 and a tube factor of 8:

$$4 \times 8 \times .9 = 28.8$$

assuming .3 as an average detector output voltage, we would have $28.8 \times .3 = 8.64$ volts available at the output of the first audio tube (201-A type). Feeding this into a 3 to 1 coupling for the 210's in push-pull we would have $8.64 \times 3 = 25.92$ volts available at the grid of a single 210 or $25.92 \div 2 = 12.96$ volts on each grid of a 210 push-pull combination, as the input voltage is divided between the two grids equally. Reference to tube data shows the 210 at 425 volts to use a grid bias of 35 volts negative. In push-pull amplification the input-voltage may safely equal the maximum grid bias voltage. Therefore, an input grid voltage of 12.96 on each grid will not work the tube to its capacity as only about one-third maximum allowable input-voltage is obtainable under these conditions. If the detector output-voltage is raised to .5 volts the available voltage on each grid would be: $(.5 \times 4 \times 8 \times .9 \times 3) \div 2 = 21.60$, approximately only three-fifths of the usable maximum, and 0.5 detector output is quite a high output voltage where tonal quality is a major consideration. On distance reception it is also advantageous to have plenty of reserve power because the detector output voltage will be much lower, probably not over 0.1 volt and when this condition occurs the voltage input to the 210 tubes is so small that efficient operation is impossible. The addition of a third stage, properly balanced and controlled, will provide a voltage amplification sufficient to work a push-pull stage of 210's or 250's to their limit. Resistances may be used across transformer secondaries so that a voltage gain of from 100 to 200 would be available if needed. Analysis of the above discussion will show that power will be available even on weak signals, and certainly the radio frequency system and detector need never to be overworked in order to secure good loudspeaker volume on any audible signal at the detector output. It places the job of working the loudspeaker on the audio amplifier where it belongs, and not on the detector, as is so many times necessary to get good volume. As previously stated, resistances of from 100,000 to 500,000 ohms may be placed in shunt across each audio transformer secondary to stabilize and smooth out the control of any excess power. Correctly done this will make the amplifier just as stable and easy to handle as any regular two-stage unit as commonly used, and at the same time provide a powerful, resilient and extremely faithful power-amplifier. Detail is given to this phase because it is believed this factor is a common cause of distortion in many receivers, especially on semi-distant reception. The inadequacy of the audio units to properly amplify signals of the order of .1 to .3 volt from the detector sufficiently to give satisfactory loudspeaker volume, so much desired by fans today and, as is

(*Continued on page* 120)

ASTON RADIO CABINETS

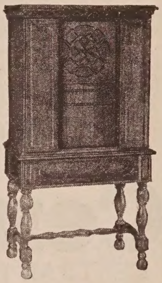


No. 229 Closed

CLASSIC Beauty in design is uniquely displayed in this ideally proportioned cabinet. Side panels of select Oriental Walnut Diamond matched with delicately scrolled Walnut overlay. Full length doors of beautifully figured matched Butt Walnut with Walnut overlay of cathedral design fold back against the side panels. Back of doors and mounting panels richly ornamented by a series of mitered return mouldings that will please the most discriminating eye and when open gives the appearance of an open face console.

Dealers and Set Builders

Write for our 1929 catalog. It will give you full details about this beautiful cabinet as well as other pleasing ASTON models. Our attractive discounts will interest you.



No. 229 Open

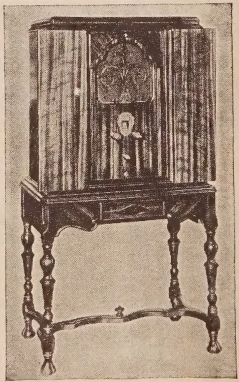
ASTON
CABINET MANUFACTURERS
1223-1229 West Lake Street
Chicago, Illinois

RADIO MANUFACTURERS ASSOCIATION RMA MEMBER

Distinctive Originality in Design of High Grade Radio Cabinets

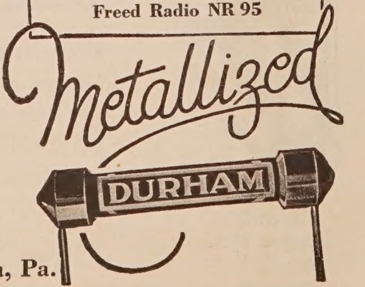
Only the BEST is Good Enough for the FREED RADIO

IN the automobile field there are several makes of axles —but there is only one TIMKEN—the axle that is installed in the leading cars of the industry. In radio there are many makes of resistances—but only one DURHAM—the Resistors and Powerohms which are used by leading quality receivers in the industry. Freed Radio easily could cut the cost of their resistances by a small fraction, but their engineers, their dealers, their jobbers and their ultimate consumers get added value in finer reception because FREED RADIO RECEIVERS use Durhams. The presence of Durhams in a receiver is a guide to the quality of all other parts. *We shall be glad to send engineering data sheets and samples for testing upon request. Please state ratings in which you are interested.*



Freed Radio NR 95

DURHAM Metallized RESISTORS and POWEROHMS are available for every practical resistance purpose in radio and television circuits, 500 to 200,000 ohms in power types; 1 to 100 meghoms in resistor types; ratings for all limited power requirements; standard, pigtail or special tips.



DURHAM METALLIZED
RESISTORS and POWEROHMS

INTERNATIONAL RESISTANCE CO., 2006 Chestnut St., Philadelphia, Pa.

FOR WANT OF A NAIL . . .

EVERYBODY remembers the verse about the courier in the battle of Waterloo speeding to get reinforcements for Napoleon. His horse faltered and fell. For want of a nail a shoe was cast . . . and the battle lost.

A radio receiver is very much the same. You may have the "reinforcements" in the form of fine workmanship, good condensers, good transformers and yet there may be a "nail" that causes trouble. Look to the volume control for a great amount of grief . . . mechanical and electrical noise . . . inadequate and uneven control. Are those the symptoms?

Then turn to Centralab controls whose quality is vouched for by this fact: the great majority of radio manufacturers include them as standard equipment. Be sure the manufacturer of the receiver you sell has done likewise.

Centralab

CENTRAL RADIO LABORATORIES

20 Keefe Avenue Milwaukee, Wis.

Cunningham RADIO TUBES

Cunningham
Cunningham RADIO TUBES
Standard Since 1915
TYPE
CX-
Since Cunningham 1915

Standard Since 1915

14 years of proved reliability . . .

Cunningham Radio Tubes continue to supply the demand for absolute inbuilt integrity and tube quality.

E. T. CUNNINGHAM, INC.

New York Chicago San Francisco
Dallas Atlanta

usually the case, overload their detectors and radio frequency units to obtain, gives the well-known result; miserable quality, shrill, raspy tone, and anything but pleasing tonal output.

The Symphonic audio transformers are designed to give substantially straight-line amplification from 50 to 6000 cycles. After 6000 cycles the amplification should fall off rapidly to compensate against static, regenerative squeals, and noise-level beyond the musical range.

The push-pull input transformer, used to couple the 210 or 250 amplifier tubes, has the same characteristics and is of the highest quality. Attention is also called to the condenser C_3, Figure 4, across one secondary of the push-pull input transformer. This is generally needed to prevent the amplifier from "singing" and should be between .00025 and .0005 mfd., the smallest value needed should be used. Push-pull amplification is incorporated because it is undoubtedly the most perfect.

Power Supply Parts

The part lists are given for reference because the success of this power-plant and master amplifier is due entirely to the specific selection of parts scientifically designed to do the work assigned. For the power supply as in Figure 2 the parts are:

1	Silver-Marshall super-power transformer No. 328.
1	Samson No. 463 filament transformer
2	Samson No. 312 heavy duty chokes—30 H.
1	Electrad Universal voltage-divider unit
3	Tobe No. 1104 4 mfd 1000 W. V. filter condensers
7	Tobe No. 301 type 1 mfd filter condensers
2	Jones Multiplugs (12 contact type), 1 for a. c. leads and 1 for "B" taps
1	Universal power clarostat (40 watts)
1	General Radio No. 439 center tapped resistance
2	Triad, Cunningham or Arcturus 281 rectifiers
2	No. 874 voltage regulators

Amplifier Parts

The parts for the Symphonic master audio unit (Figure 4) are:

1	Samson No. 85 helical wound r. f. choke, 85 mh.
2	Samson Symphonic audio transformers
1	Samson Symphonic push-pull input transformer, type Y
1	Samson push-pull output impedance, type Z
2	General Radio No. 214-A center tapped resistances, 2500 ohms
1	Carter P-10 100-ohm resistor (1 slider)
1	General Radio No. 439 center tapped resistance
2	Tobe No. 602 2 mfd filter condensers
2	Carter Hi Watt, 0-2000 ohms
1	Carter Hi Watt, 0-100,000 ohms
2	Carter Hi Watt, 0-30,000 ohms
2	Tobe No. 201 by-pass condensers
1	.00025 Tobe "Tiny Tobe"
2	Tobe "Tipon Leaks, ½ and ¼ meg.
2	General Radio sockets No. 349
2	General Radio sockets No. 438
2	Triad, Cunningham or Arcturus 210 type power tubes
2	Triad, Cunningham or Arcturus 227 type tubes

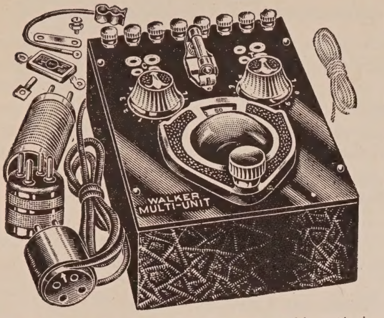
With the Professional Set Builder

(*Continued from page* 92)

Killing A. C. Hum

ELIMINATION of a. c. hum from dynamic speakers, alternating current operated from low voltage type rectifiers, may be secured by the use of a filter placed across positive and negative terminals of the rectifier as is shown in the sketch in Fig. 2. The Potter Co., North Chicago, Illinois, are

(*Continued on page* 122)



A Delightful Radio Entertainer

GEORGE W. WALKER MULTI-UNIT

A Device with a Dozen Uses

SHORT WAVE RECEIVER
SHORT WAVE ADAPTER
REGULAR BROADCAST RECEIVER
SCREEN GRID PRE-AMPLIFIER
R. F. OSCILLATOR
EXTRA STAGE OF R. F. OR "BOOSTER"
RADIO "EXPERIMENTAL" UNIT
CRYSTAL RECEIVER
WAVE TRAP
WAVE METER

One of the most unusual radio instruments ever devised. Will perform any individual function of a complete receiver, and in addition may be used for calibrating, testing or checking. Makes a wonderful broadcast receiver, short wave receiver or transmitter. Oscillates violently over the entire scale range from 550 meters down to 15. Uses all tubes 199 to 210 and all voltages, AC, DC or rectified. Nothing like it ever placed on the market before.

The Radio Fan has at his disposal a device which will provide him with something to tinker with for an entire season without performing the same experiment twice. Become acquainted with all the circuits and the way tubes perform under particular conditions.

The Dealer and the service man requires this most valuable instrument for adjusting radio frequency circuits to resonance, providing a beat note or constant frequency oscillation for determining wave length of a particular condenser setting, calibrating a receiver, disposing of trade-ins and obsolete sets by making them up to date by the addition of a R. F. amplifier.

NO ANTENNA-GROUND NEEDED

When using the Multi-Unit with most any receiver as an R.F. Booster (extra stage T.R.F.), the sensitivity increase is sufficient to make unnecessary the use of outside antenna. Tone quality is immediately improved. Less external electrical interference assured.

SHORT WAVE CONVERTER
(15-95 Meters)

Enjoy the novelty of short wave experiments by converting your present receiver to tune to the low waves. Utilizing the audio amplifier in your own receiver serves a dual purpose and increases volume and range. Plug the unit adapter into the detector socket of your set. No change in wiring or extra tube required. The Multi-Unit will function with either A. C. or D. C. receivers.

R. F. PRE-AMPLIFIER

Uses same type tube as in the R. F. stages of your present receiver. 199, 201-A, 222, 224, 226 or 227 tubes may be used. Either A. C. or D. C. Extreme selectivity, if you prefer. Tune in stations you never heard before. This efficient circuit reduces static and other interference. Greater clarity results as the additional volume makes over-loading of tube filaments unnecessary.

SCREEN GRID R. F. BOOSTER

Increase the range and volume of your present receiver to equal the latest improved Screen Grid Receiver. Merely insert unit adapter plug in socket of your receiver. No change in receiver wiring. Adaptable to either A. C. or D. C. receivers.

SHORT WAVE RECEIVER (15-95 Meters)

Experiment with the fascinating short waves. Tune to stations thousands of miles distant. Reception of short wave Foreign stations has been verified. Ideal all-year-around reception. Warm weather in Australia and New Zealand is winter in this country. Hundreds of short wave stations thruout the World are listed.

SINGLE TUBE RECEIVER

Ideal for either short wave or regular broadcast band.

SHORT WAVE R. F. BOOSTER

Connect the unit ahead of your short wave set and hear stations with greater volume. Uses screen grid or 201-A type tube.

R. F. OSCILLATOR

Check your receiver for wavelength and calibration. Determine resonance of circuits, test tubes for oscillation and regeneration, neutralizing receivers, balancing condensers, laboratory measurements, short distance transmission and generating a beat frequency for superheterodyne.

There are numerous additional uses, a few of which are wave meter, Loop R. F. Amplifier and growler for measuring efficiency of shielding material. By the time an experimenter has exhausted the possibilities of this instrument he will be qualified for a radio engineer.

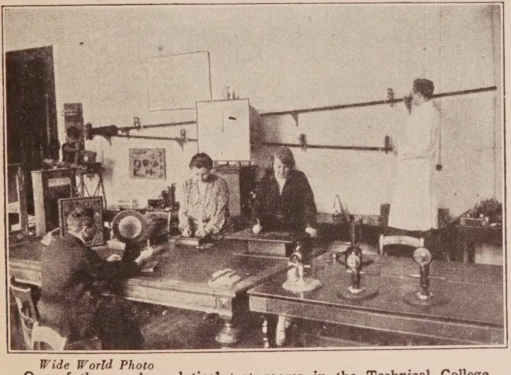
Consists of the essential parts of an oscillatory circuit, and in addition are plug-in coils, adapter cord and plug, bridging connections, and extra wires along with well detailed instructions for many major experiments. Entire unit contained in box 7½ inches by 5 inches by 3½ inches. **Price..........** **$16.00**

AT YOUR DEALER OR MAIL YOUR REMITTANCE DIRECTLY TO FACTORY

THE WORKRITE RADIO CORP., 1814 E. 30th Street, CLEVELAND, OHIO

SERVICE MEN—DEALERS—JOBBERS—MANUFACTURER'S AGENTS WANTED

Test Pupils in Berlin Colleges



Wide World Photo

One of the psychoanalytical test rooms in the Technical College, Berlin, where fitness for various trades and professions is determined. Tests are for eyes, sense of touch, steadiness and mental ability. Photo shows pupils and teachers at work in one of the test rooms.

Many Diseases Now Treated by X-Ray and Radium

Many other diseases besides cancer are now being diagnosed and treated by X-rays and radium, and this method of treatment has grown so that it is becoming a new medical speciality in itself, Dr. Albert Soiland of Los Angeles stated at the meeting of the American Medical Association in Portland, Ore.

Inflammations, sinus disease, erysipelas, asthma, neuritis, arthritis, and even sciatica and trifacial neuralgia are among the diseases that have been improved or altogether cured by radiation treatment. The scope of the field is tremendous.

New Money on Best Possible Paper

Lives of dollars, two-dollar and five dollar bills would be still further lengthened if some treatment could be developed for the paper on which these are printed which would increase the surface wear resistance.

This was admitted recently by E. W. Scribner, chief of the Paper Section of the U. S. Bureau of Standards, who said that experiments at the U. S. Bureau of Standards with glue sizing for this purpose were not yet satisfactorily concluded.

"We are investigating this matter still further," Mr. Scribner said, "and may have reports to make later."

Recent experiments indicate that increased resistance to surface wear can be obtained by hardening the present glue sizing by after-treatment with formalde-hyde.

Among the changes worked out by the Bureau of Standards in improving the folding endurance of paper to be used for U. S. currency have been the substitution of one-fourth cotton fiber for the former all-linen fiber used; the use of caustic soda rather than lime in cooking the paper-making rags; and modifying the beating treatment of the paper fiber. The substitution of cotton for part of the linen reduces the cost.

The beautiful quality of the paper produced by the Bureau in experiments in recent years had never been duplicated in a commercial establishment up to the time of the Bureau's demonstration. Immediately taking over the processes developed by the Bureau, commercial manufacturers in 1926 began to produce paper with 100 per cent greater folding endurance.

Constant co-operation on the part of the Bureau of Standards and paper manufacturers since 1926 has resulted in still further improvements in paper-quality.

The new small-size currency just being issued is probably the first U. S. paper money to be produced on paper which may truthfully be said to be the finest possible to make.

TUBES DON'T EXPLODE WHEN THEY BURN OUT. BUT THEY MIGHT JUST AS WELL—A BURNED OUT TUBE IS USELESS.

It usually happens when you want to get some special program—yet a THERMATROL Voltage Control that will protect the tubes against excess voltage can be bought for a fraction of the price of one tube.

LIGHT DUTY No. 200
Price $1.75
For sets up to 6 tubes

HEAVY DUTY No. 210
Price $2.00
For all larger sets

THERMATROL

Thermatrol Mfg. Co.
52 Willow St. Springfield, Mass.

making a dynamic speaker filter that is small and compact. The filter is connected as shown in the diagram and should eliminate a. c. hum present due to incomplete rectification.

Replacement Transformer

RECENT announcement has been made by Thordarson Electric Mfg. Co. of Chicago, Illinois, of the R-100 illustrated in Fig. 3. It is a quality replacement audio transformer designed for the service men for reconditioning radio receivers with obsolete or burned out audio transformers. The mounting bracket of this unit is universal in its application. It may be mounted on end or on its side, either above or below the sub-panel, or may be used as a bracket for the sub-panel itself. The bracket is slotted in such a way to permit substitution without drilling additional mounting holes. Its dimensions are 2 7/16 x 1½ x 2 inches high.

Hum on Carrier Wave

MANY complaints have been received from listeners that in tuning a receiver on the carrier of a station whose microphone is idle, a disturbing a. c. hum is heard. Service men report that this a. c. hum on an idle carrier may be eliminated in many cases by connecting a 1/10 mfd bypass condenser from the underground side of the 110 volt line to the ground. One should be sure in making this connection that the condenser is one that will have a rating in excess of the 110 volt line since this is a permanent connection. The condenser may be connected to the ground and the other terminal tapped alternately on one side of the line and then the other to determine which is the ungrounded side. It might be well to mention that the a. c. rating of any condenser is one-half of the direct current rating so that in order to get one for the 110 volt line it should have a d. c. rating of at least 220 volts.

Substituting 245 Tubes

ACCORDING to Electrad, Inc., 173 Varick Street, New York, greater power output and a higher degree of fidelity may be obtained from the Radiola 41 by substituting the new 245 tube for the 210 tube. The only circuit change is the addition of a resistance in series with the 7.5 volt winding to reduce the filament voltage to 2.5 volts. A type B-03 Electrad Truvolt is connected in series between one of the yellow leads in the cable and one terminal of the 7.5 volt line. The 3 ohm resistor thus is in series with 7.5 line and reduces the voltage to the proper value for a 245 tube. A small leaflet for service and repair men advising how this may be done may be had upon application to the company whose address is given above.

Sign Flashers Emit Interference Like a Simple Transmitter

(*Continued from page 94*)

Smaller types of signs and blinkers frequently approach this ideal construction, as they are usually constructed of metal which is used to house the flasher mechanism as well as the lamps.

To determine whether the interference being picked up by the radio set is primary or secondary in character, the following procedure should be followed:

Disconnect the antenna and ground from the set. If the interference is still audible, this indicates that it is due to the coupling of the set to the power lines. If no interference is audible, it would indicate that interference is being picked up by the antenna and ground system of the set. The ground wire should then be attached to the set. If the interfer-

(*Continued on page 124*)

EXTRAORDINARY VALUE!

KOLSTER

Electro Dynamic Reproducer

Combined with 210 Power Amplifier and "B" Supply Unit

This famous genuine Kolster K-5, AC Electro-Dynamic Reproducer is complete with a 210 Power Amplifier and "B" Supply Unit all self-contained on a steel frame. This real fine matched rugged Unit weighs 45 lbs. without the Cabinet. The Cabinet itself is Pencil-Striped Walnut, beautifully designed with Cathedral grille.

If desired, the 210 Power Amplifier will also supply 22, 67 and 90 volts "B" current, sufficient for any set using up to 8 tubes. An automatic voltage regulator tube, UX-874, maintains the "B" voltage silent and steady.

This Electro-Dynamic Reproducer can be used with any battery or AC set, replacing the last audio stage, or be used with all tubes of the set. Wherever used it will bring out every shading and range of tone; every note is reproduced with utmost faithfulness, pure and undistorted. It will modernize any radio receiver.

Uses 1—UX-210, 2—UX-281 and 1—UX-874 tubes.

A 20-ft. cable is included with each instrument. Operates direct from 50-60 cycle, 110-120 volt AC current.

Brand new in original factory cases and guaranteed. Every Reproducer is serial-numbered and has factory guarantee tag enclosed.

Model K-5

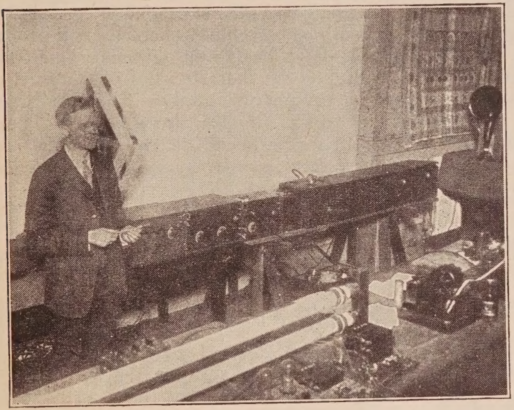
Height 42"—Width 25½"
Depth 19"

List Price $175.00
(without tubes)

Never Before $49.50

AMERICAN SALES COMPANY, 19-21 WARREN STREET, NEW YORK CITY

The DX Hound's Dream



Wide World Photo

Powerful receiving set used for measuring speed of radio waves. Capt. R. H. Ranger with first long wave receiver ever built without outside connections. It is a fourteen tube set with a super selective high power receiver for relay control, the batteries being contained in the set. The set was used in measuring the speed of a message sent from the Radio Corporation of America at New York, picked up at Warsaw, Poland, and came back on a lower wave length, the time of the 8500 miles being covered in 0.054 second.

Finds Americans Losing "Pep"

The famous "pep" so long characteristic of the American people is becoming a thing of the past, it appears from observations reported to the American Medical Association by Dr. C. W. Dowden of Louisville, Ky. Dr. Dowden finds exhaustion or "lack of pep" is a constantly increasing complaint among his patients. About one of every five during the last two years have consulted him because of exhaustion, and had no specific underlying disease.

Dr. Dowden gave four principal causes of this condition: the World War with its effect on the mental make-up of the people; influenza and its persistent after-effects; the quantity of bad alcohol drunk by both men and women; and carbon monoxide saturation of the atmosphere as a result of the increasing use of automobiles.

While exhaustion is often attributed to glandular disease, Dr. Dowden thinks this particular type is due to a depletion of the individual as a whole. It may be considered under two headings: chronic infection in respiratory and biliary tracts; and mental depression resulting from emotional, financial or business worries. Medical treatment for this sort of exhaustion will not be satisfactory unless the underlying cause is found and corrected.

California Forest Fires Follow Several Dry Years

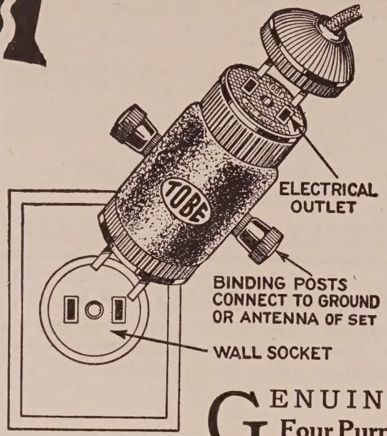
The forest fires now raging in a number of California timber areas are the cumulative harvest of several dry years in the coast state, officials of the U. S. Forest Service have informed Science Service. The normal state of the "duff," or partly disintegrated mass of leaves and twigs on the forest floor, is one of considerable dampness; but in summer the duff always dries out more or less in its top layer, causing a fire risk. After a succession of winters with too little rain, this drying goes deeper, making fires more likely to occur, and worse when they do occur. Fires are normally expected in California forests in summer, the Forest Service explained, but the present outbreak is rather worse than the average.

Radio Room on Liner "Bremen"

Photo by Wide World

Photo shows the radio room of the new German ocean liner "Bremen," having recently made the trip to New York in record breaking time on her maiden voyage.

FREE!


TOBE
ELECTRICAL OUTLET
BINDING POSTS CONNECT TO GROUND OR ANTENNA OF SET
WALL SOCKET

GENUINE Tobe Four Purpose Light Socket Aerial

FREE with one year's subscription to Citizens Radio Call Book—Radio's Greatest Magazine.

The Tobe Socket Aerial solves many aerial problems and does many things—just put plug in your electric light socket and hook your radio set to one side, your ground to the other and you still have your electric outlet.

Static minimized—construction of plug prevents excessive pickup of static—increased selectivity—improves tone quality. Tuning is sharpened—your set will tune much more sharply when you use a Tobe Aerial, than when you use an outside aerial. **Each aerial guaranteed for two years, unconditionally.** Full instructions showing many combinations accompany each aerial.

Send This Coupon Today!

CITIZENS RADIO SERVICE BUREAU
508 So. Dearborn Street, Chicago, Ill.

Here is my $1.75 (Foreign $2.00) for which please send me a Tobe Four Purpose Light Socket Aerial FREE and enter my subscription for the Citizens Radio Call Book Magazine for one year starting with the

☐ **September** ☐ **November** ☐ **January** ☐ **March**

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ence is then audible, it would indicate that this interference is being picked up by the ground system, and is due to either radiation or conductive coupling. If no interference is audible until the antenna as well as the ground is connected, it would indicate that the antenna system is picking up the disturbance.

In the case of interference being audible in the set without the ground or antenna connected, it is necessary to install the proper type of filter† directly at the flasher mechanism before being able to determine whether the interference is primary or secondary in character. Installing the filter should entirely remove the interference which is audible without the ground and antenna being connected. With the interference thus cleared up, the ground should then be connected. If it again becomes audible, it would indicate that there is secondary interference present. Connecting the antenna system should increase this interference. It then becomes necessary to install an additional filter between the flasher mechanism and the sign, or to install a special filter designed to take care of both types of interference.

In general, the interference is primary in character with slight secondary power line characteristics when the flasher mechanism and the sign are enclosed in the same housing, or the mechanism and the sign are closely associated. Where a central control flasher system is used for actuating blinkers or signs, or where the leads from the flasher mechanism to the sign are ever 10 feet long and are not carried in conduit, interference of both primary and secondary character will probably be present. Just how objectionable the secondary interference will be will depend upon the characteristics of the particular installation which is causing the trouble. The best practice to follow is to install a filter to take care of primary interference, and thus through experiment, determine whether additional filters are necessary in order to secure complete interference elimination.

Thordarson Push-Pull Amplifier and Plate Supply for 245's

(*Continued from page* 57)

to two of the sub-panel brackets. The wiring is covered with rubber tubing for insulation, this being the easiest to use. Some of the leads in the illustration are shown to be twisted. All of the filament leads and common condenser leads may be twisted or bunched and laced together making a neater and more compact appearance. The use of sub-panel brackets also makes most of the wiring come below the baseboard.

Changing Current Needs

In some cases where comparatively large currents from the 45 volt tap are required, it is necessary to lower the value of the resistance between the 45 and 90 volt taps. It is impossible to make the change in the divider itself, but it may be easily accomplished merely by connecting a 10,000 or 15,000 ohm potentiometer with one side connected to the 45 volt tap, the other side connected to the 90 volt tap and the variable voltage being obtained from the binding post connected to the movable arm which is now the 45 volt tap. This arm is adjusted for desired results. In this case a variable tap should be by-passed to B negative with a 1 mfd condenser.

Official Parts List

1	Thordarson R-245 compact
1	Thordarson T-2922 push-pull input transformer
1	Thordarson T-2880 push-pull output transformer (for high impedance speakers) or T-2903 push-pull transformer (for dynamic speakers)
1	Thordarson R-508-1 resistance unit
1	Electrad 1T resistance unit

(*Continued on page* 126)

JEEMS

EASY TROUBLE SHOOTER

The Quick Method for Locating Trouble in Your Receiver

REVISED to include all of the forty licensed factory sets as well as superheterodynes, this handy chart is highly recommended by service and repair men as a valuable asset in the work shop.

Accurate, Sure, Complete, Practical

By Mail, 50c

Roberts Radio Service

Caxton Building **Chicago, Illinois**

FROST-RADIO

wants you to have a copy of its valuable 16-page Parts Catalog FREE

We want every reader of Citizens' Radio Call Book who has not yet received a copy of our big 16-page Parts Catalog to use the coupon for requesting his copy today. This catalog contains a vast amount of useful information, in addition to illustrating and describing the complete line of Frost-Radio parts and accessories. It describes our big special offer to radio set builders. It tells about special hook-ups, short cuts, "how to do things better."

Get your copy of this book right away. Remember, it's FREE for the asking. So just mail the coupon now and get your copy by return mail.

HERBERT H. FROST, Inc.

***Main Office and Factory:* ELKHART, INDIANA**

l. Non-Corrosive

outside). Has 150 feet of olid zinc. Newest design. nent installation requiring iency. Send **$10.00**

European Test

Special "BIG BOY" size. Same general construction as 30 ft. but uses 300 ft. of wire and is 60 ft. long. Most power aerial built. Send check or money order. Price $12.50

UCTS

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Welcome you
to DETROIT

HOTEL FORT SHELBY
HOTEL FORT SHELBY

HOTEL Fort Shelby offers the dual advantage of a hushed, peaceful environment . . . and immediate proximity to the financial, theatrical and shopping centers of downtown Detroit. With its new 22 story addition, equipped with the most modern comforts and appointments (including Servidors) 900 attractive rooms are available to our guests.

Whether your choice be one of the many very comfortable rooms at $3 or $4 a day, or one of the richly furnished suites with an enchanting view of city, river and Canadian shore, you will enjoy a special sense of value at this hotel. At your request (by letter or wire), we'll reserve tickets to theaters, concerts and sporting events.

Look for the large green sign atop the 22nd floor. Write for direct motor route to the hotel. Attendants promptly take care of arriving cars.

DETROIT

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J. E. FRAWLEY, *Managing Director*
Lafayette and First
DETROIT

LOWEST PRICES & QUICKEST SERVICE

TO Dealers and Set Builders in the Tri-State territory, we offer the best possible service on Radio Sets, Kits, Parts and accessories. Our large stock allows us to ship all mail orders the same day they are received and our varied stock gives you a wide range of choice.

Send for our large catalog—it's free. In it you will find all the popular kits and parts at the lowest prices. Just put your name on a postcard and address it to Dept. A.

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PITTSBURGH PA.

- DISTINCTION -

THE 770 and 780 Designs by Ensall Radio Laboratory, Designers of Custom Built Radio Apparatus, are a Seven Tube Tuned Radio Frequency and an Eight Tube Super Receiver, respectively. Distance Receivers for those who desire only the utmost in Radio Designs. The products of a long experience in the designing of special Radio Apparatus.

Distinction is emphasized in the features of these new Designs. An entirely New Circuit Design, 100% Amplification with A/C Shield Grid Tubes. Perfect reproduction with the 245 Push-Pull Amplifier, Distance
Unit Trans-
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WALL SOCKET
GENUINE
Four Purpose
Socket AORY
FREE with one year's subscript
Citizens Radio Call Book—E

The RESORT HOTEL OF THE NATION'S CAPITAL
Within Ten Minutes of THE WHITE HOUSE
1200 Sunshine Rooms (all outside) with Bath
$5.00 Single - $8.00 Double
RIDING - GOLF - SWIMMING - TENNIS
L. G. MOORE . . Managing Director
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AERIAL SEARCHLIGHT VISIBLE FIFTY MILES CASTING ITS RAYS FROM OUR ROOF
WARDMAN PARK HOTEL
Washington, D.C.

1	Dubilier PL1429 condenser block
1	Electrad B 8.5 fixed resistance 850 ohms
3	UX sockets
9	Binding posts
1	Pc. bakelite 3 x 11 x 3/16 inch

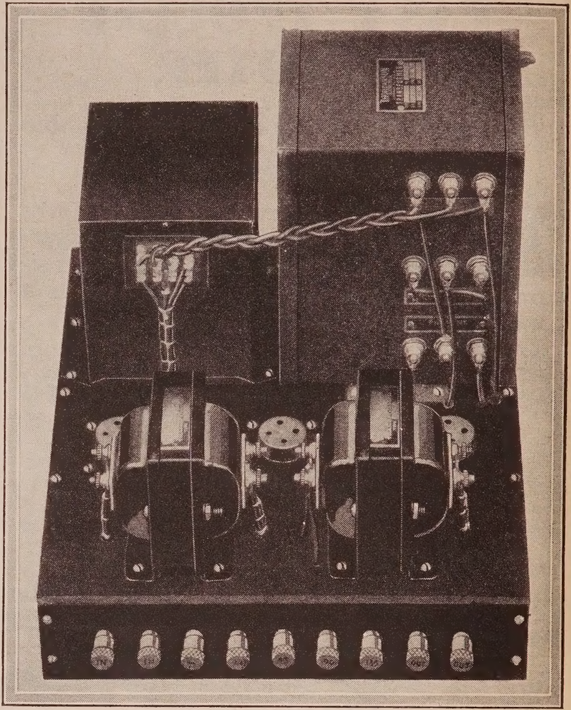


Fig. 2. The completed job is shown in the above photograph. It is built on a subpanel instead of a baseboard

1	Wood baseboard 1 x 11 x 14 inches
1	Package Corwico Braidite hookup wire
2	Triad, Cunningham or Arcturus 245 power amplifier tubes
1	Triad, Cunningham or Arcturus 280 rectifying tube

Aero Short Wave A. C. Converter For Distant Broadcast Programs

(*Continued from page* 54)

back of the converter, connect the aerial binding post on the rear of the unit and insert the converter plug in the detector tube socket of the broadcast receiver. In order to obviate the necessity for these operations being performed each time it is desired to change from the broadcast to the short waves, it is suggested a separate 227 tube be purchased and that it be allowed to remain in the converter all the time.

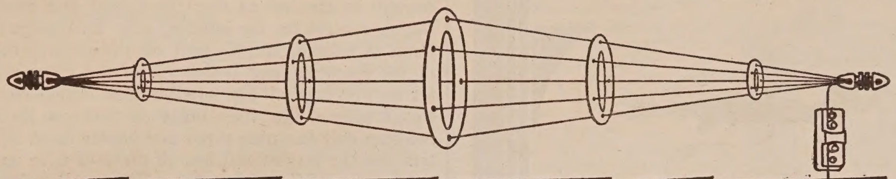
In the operation of a short wave converter it should be remembered that the tuning controls of the broadcast receiver are not touched since all of the tuning is done by the central knob on the dial of the converter. No ground wire is required for the converter as it is already attached to the broadcast receiver. The small knob in the center of the converter panel is the wave length tuning control and should be rotated slowly and carefully while listening for a station's signal. The small knob on the lower left corner of the converter panel is the volume control or regeneration control and should be turned

(*Continued on page* 128)

LIFE-TIME DX AERIAL

DISTANCE

SELECTIVITY



Guaranteed Double Volume and Sharper Tuning

A Unique Radio Principle

This astounding discovery in radio antenna construction is the work of one of radio's best known engineers. It is so far superior to the ordinary single strung wire that no receiving set can be considered at its best without it.

There is nothing else like it. It possesses power, selectivity, and "non-fading" characteristics that have always been the hope of radio builders and users.

All connections double-riveted or clinched.
Minimum electrical loss or leakage.
Increases volume without distortion.
Improves selectivity.
Helps prevent interference.
Multi-aerial principle — non-directional.

Makes Any Radio Better

Life-Time DX Aerial will improve any radio—old or new. Sharpens tuning because of short length. Increases volume and distance because of using several lengths of wire. Duplicates design of aerials on largest Broadcasting Stations. Easily installed. Always at its best because wire is enameled and non-corrosive. Endorsed by all set owners including short wave fans. Bring your receiver up-to-date. Install Life-Time DX Aerial.

Guaranteed Double Volume

Replace your old style aerial with this new invention and watch your volume increase. Brings new life to radio reception and lessens "fading."

30 Feet Long—Equal to 150 Ft. Aerial. Non-Corrosive

Completely assembled. Ready to string up (preferably outside). Has 150 feet of wire but is only 30 ft. long. Rings are heavy gauge solid zinc. Newest design. Acclaimed a great advance in radio reception. A permanent installation requiring no attention or replacement. Always at maximum efficiency. Send check or money order. Price $10.00

60 Ft. Length European Test

Special "BIG BOY" size. Same general construction as 30 ft. but uses 300 ft. of wire and is 60 ft. long. Most power aerial built. Send check or money order. Price $12.50

THOROLA RADIO PRODUCTS

1014 So. Michigan Avenue
CHICAGO, ILLINOIS

Organist Uses "Eleventh Finger"

Wide World Photo

As though the ten fingers of the human hand and all the numerous stops on the modern organ were not sufficient to produce the blend of sound known as music, William Hoffman has invented what he terms an eleventh finger. The "finger" consists of a band which fits snugly around the organist's head and to which is attached a long extension rod curved downward on the end, enabling the player to reach to the third or fourth manual. The device enables the player to play a melody on either of the two upper manuals and allows him to use his two hands for variations, second touch effects, etc. Photo shows William Hoffman operating the organ with the aid of his "eleventh finger."

Government Urges Caution in Handling "Dry Ice"

The number of claims which have been filed with the Ohio Industrial Commission for injuries received while using frozen carbon dioxide, or "dry ice," for industrial purposes, has caused the U. S. Government to issue a warning to workers.

The "dry ice" has recently come into extensive use for commercial purposes especially in ice-cream and dairy plants. Its temperature is about 110 degrees below zero or 140 degrees below the temperature of ordinary ice. Although it looks harmless enough it can do considerable damage to the person who handles it with bare hands. Numbness and pain, not only in the fingers but also in the hands and arms are the first symptoms, and in some cases a form of neuritis is produced.

Talking Movies to Teach History

The first educational talking movie to be produced for the general use of schools and colleges is now in preparation. This announcement was made recently by the University Film Foundation, which is associated with Harvard University. The film, which will inaugurate a series of educational talking movies, will be entitled "The Corner Stone of the Nation" and will relate the history of Massachusetts from the founding.

Cameramen are now taking the pictures on the actual spots in which history was made, with actors, dressed in authentic costumes of the period, to play the historical characters.

The talking part of the film will consist of a lecture on the scenes, delivered by Prof. Albert Bushnell Hart, famous Harvard historian. When the photography is complete, Prof. Hart will deliver the lecture into a microphone as the film is shown before him. His words will be recorded, then printed.

When these films are shown in a sound movie projector, such as is used in the theaters, Prof. Hart's lecture will be reproduced as the film is shown. In this way schools throughout the country may have both the pictures and the talk.

A portable sound movie projector, for use with this sound on film method of recording, which is used by most of the commercial producers, is about to be placed on the market.

SMASHING

ALL RECORDS
for TIME
on the air

ACTS IN 7 SECONDS

ARCTURUS

BLUE A-C LONG-LIFE TUBES

ARCTURUS RADIO TUBE CO., NEWARK, N. J.

AEROVOX

BUILT BETTER
CONDENSERS AND RESISTORS

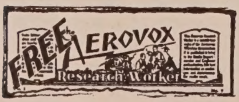
False Economy
Is Costly

Nothing is likely to prove as costly as a cheaply made, over-rated condenser or resistor.

Whether you are a manufacturer, professional set builder or experimenter, you cannot afford the high cost of a cheap condenser or resistor.

Aerovox condensers and resistors are conservatively rated and thoroughly tested. They are not the most expensive, nor the cheapest, but they are the best that can be had at any price.

A Complete Catalog with illustrations and detailed descriptions may be obtained free of charge on request.



The Aerovox Research Worker is a free monthly publication that will keep you abreast of the latest developments in radio. Your name will be put on the mailing list free of charge on request.

AEROVOX WIRELESS CORP.
72 Washington Street, Brooklyn, N. Y.
PRODUCTS THAT ENDURE
RMA

towards the right to increase volume but not to the point where the set squeals or howls. If no signals are heard turn this knob a little further to the right and retune as before, being careful not to pass over a station since the short waves are very sharp and tuning must be carefully done. When a signal is heard or the set squeals turn the volume control knob just enough to the left to stop the squeal and readjust the main tuning control for the loud signals. To change from one wave band to another simply pull off the plug-in coil on the rear of the converter and insert one of the other coils, tuning the set as previously. The smallest coil which covers from 16.5 to 32 meters, has four turns of wire on its secondary, the medium coil has nine turns and covers from 26.2 to 48.7 meters and the largest coil has 18 turns of wire on its frame and tunes from 46.7 to 90 meters. The small primary coil which is hinged on the rear of the converter can be moved to or from the secondary coil for best results. After once being set it is rarely changed while the same plug-in coil is used, although it may be varied for maximum signal strength.

Preventing Motorboating

It will be observed that on the upper right-hand corner of the converter there is a variable knob for the B power filter. This knob should be turned gently to the right as far as possible previous to starting the operation of the converter. Then with the smallest plug-in coil inserted turn on the receiver and adjust for quiet operation without motorboating. Should the converter begin to squeal or howl violently or emit a sound similar to a motorboat engine, this is caused by incomplete filtration of the eliminator on the broadcast receiver and may be corrected by turning the above mentioned filter adjustment knob to the left until the motorboating ceases. Once a satisfactory adjustment is reached the knob may be left in that position and no further manipulation will be necessary.

It will be noticed that if the filter adjustment knob is turned all the way to the left, the converter stops working as the B supply for that unit has been cut off.

The converter is housed in a neat, attractive metal cabinet which is 9 inches long, 5½ inches high and 2½ inches deep. The metal cabinet in addition to serving as a shield is also very attractive as it is of a beautiful golden brown crackle finish and is a worthy companion to any radio set.

Multi Unit Has Variety of Uses for Service Man or Radio Fan

(*Continued from page* 60)

with the Walker Multi Unit. In the case of the Booster Stage described on page 51, the circuit illustrated on page 63 and called schematic No. 2 is the one that applies. As usual the strap connection is placed across terminals G and B so as to short out the grid leak and condenser. When it is desired to duplicate the device shown on page 56, which is a simple wave trap or wavemeter, the diagram shown on page 116 and called schematic No. 17 may be hooked up. In the case of the wave trap, the neon light tube or flashlight bulb across the variable condenser is not employed. However, if it is desired to use the unit as a wavemeter, the neon tube or flashlight bulb may be retained and it will indicate resonance with the transmitting circuit when the light flashes.

In addition to the uses of this unit set forth on this page there are other hook-ups possible, such as a short wave receiver from 15 to 95 meters, a d. c. or a. c. short wave adapter of the same wavelength, an r. f. oscillator or a screen grid short wave amplifier stage. The service man and experimenter will find the circuit an interesting study. Binding posts are conveniently arranged so connections may be made to various terminals of the circuit depending upon the use of the unit

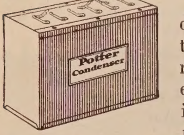
(*Continued on page* 130)

WITH THE ACCESSORY AND PARTS MANUFACTURERS

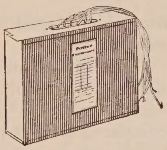
(*Continued from page 103*)

Potter Has Filter Block for B Eliminator Replacement

SERVICE and repair men will welcome the announcement made by the Potter Company of North Chicago, Illinois, concerning two types of condenser blocks which they are now manufacturing as a means of providing replacements in eliminators.

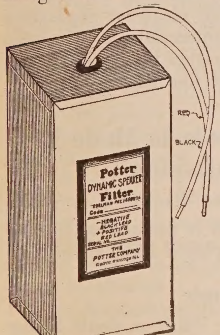


According to the design of the condenser block it will be possible to replace the B block in certain of the eliminator models without any change in wiring. For example, the condenser replacement block illustrated in Fig. 1 is designed for replacement in the Majestic Standard B, Majestic Special Master, Majestic Super B, Majestic Master B and the Brown B Super Power.



Another type of replacement block is that shown in Fig. 2 which was designed for inclusion in the Zenith ABC. power supply ZE-9, Mohawk A. C. (27-28) 226 type power unit and the power unit made by Stewart-Warner.

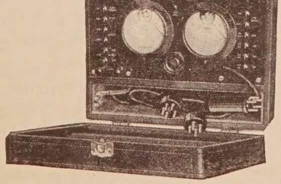
Aside from the replacement block, Potter is also making standard filter condenser blocks for use with the Thordarson R-245 compact, the Thordarson T-2950, and in the R-171 type of B eliminators using rectifier tubes with transformer having a maximum no load output of 350 volts. A standard condenser block is also made for use with the Silver-Marshall 673.



Another item carried in the Potter line which should be of interest to service and repair men is the dynamic speaker filter illustrated in Fig. 3. This filter is designed for placing across the output of a contact type rectifier so as to filter the dynamic speaker field. The unit is small an compact, permanently sealed in a metal container 2 5/16 in. by 2⅞ in. by 6 in. high with an attractive black finish.

Jewell 199 Set Analyzer Handles S. G. Tubes

WHEN used with the analysis charts and the instruction and data book supplied with it, the Jewell pattern 199 set analyzer illustrated herein provides an accurate and efficient method of checking radio receivers by service and repair men. The unit is manufactured by the Jewell Electrical Instrument Co., 1650 Walnut St., Chicago, Illinois.

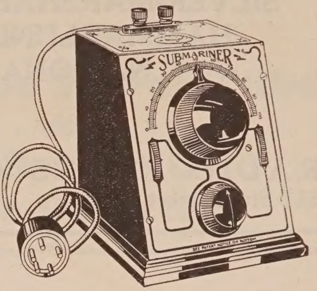


In testing a radio set the convenient five-prong plug or the four prong adapter is inserted in the tube socket. The tube is inserted in the socket shown in the set. The complete electrical operation of each stage of the receiver is

(*Continued on page 139*)

SHORT WAVE

With Your Present Receiver



Experience reception on short waves, by attaching a "Submariner" to your present receiver, whether AC or DC. There is a model for every need and requires no changes of any kind to your receiver. Only a few seconds is required to attach or detach.

Users of "Submariners" in U. S. hear England, Holland, Germany, Australia and many other distant countries broadcasting. In addition to hearing broadcasting from these far countries, thousands of code messages have been received from every part of the world.

THE SUBMARINER

has been sold in all parts of the world since 1926 and is not only the pioneer, but its many improvements enable every set owner to secure as efficient results as the best short wave receiver could give, with only a fraction of its cost. The "J" feature, an exclusive "Submariner" achievement, gives five times greater volume than any other adapter. Prices, AC or DC, are: Fixed wave band, 16-32 meters, $17.50. Fixed wave band, 16-32 meters, "J" feature, $22.50. Interchangeable coil model, 12-160 meters, $22.50. "J" feature and interchangeable coil, 12-160 meters, $27.50.

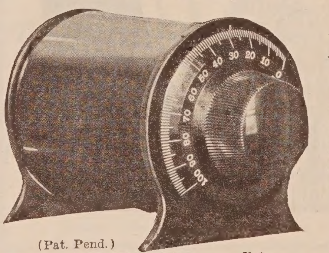
Will be sent prepaid on receipt of price, or C.O.D. if $1.00 accompanies order. Dealers and Jobbers write for sales proposition

J-M-P MFG. CO., INC.
3431 Fond du Lac Avenue Milwaukee, Wis.

Use a **REESONATOR**

TRADE MARK

for Selectivity—Distance—Clarity



(Pat. Pend.)

$4.75 COMPLETE **Not a wave trap**

Over 30,000 satisfied users.

Bring your set up to date! For all sets using an untuned floating or antenna tube, such as Atwater Kent models 30-32-35-37-38, Crosley Bandbox, Radiola models 16-17-18-51, Dayfan, Apex '28 models, and many others. Attaches across aerial and ground leads without tools in less than a minute.

It will enable you to tune sharper and plays with dance volume, stations which are barely audible or sometimes entirely inaudible without it. Requires tuning only when additional selectivity or power is required. Attractively constructed from hard rubber and bakelite in a highly polished rich mahogany color. Guaranteed against defects in material and workmanship for a period of six months. Get a Reesonator from your dealer today, or order direct, giving dealer's name.

What Some of Our Users Say

Gentlemen: We wish to inform you that the REESONATOR we purchased from you some time ago, is meeting with our highest expectations. We have found it of much value in aiding reception, increasing volume, clearness of tone and enabling us to get stations which we otherwise could not hear.
Yours truly, N. N. Fisher, Janesville, Wis.

Gentlemen: I received the REESONATOR shipped by you, safely and I am delighted with it. To say that it is all that you claim for it would be putting it mildly. I get longer distance, and what pleases me even more, clearer tone with a tremendous saving on power. Thanking you,
Yours truly,
C. M. Archibald, Halifax, Canada.

We Guarantee Satisfaction
Try one for three days at our risk. If not thoroughly satisfied your money will be cheerfully refunded.

F & H RADIO LABORATORIES
Dept. 110, Fargo, N. D.
Ref.: Fargo National Bank
Dun's or Bradstreet's

Dealers—Over sixty leading wholesalers carry this item in stock.

SEND COUPON NOW
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....Please send Literature.
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Name..

Address..............................State..................

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HAMMARLUND AND
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CLINTON
OPPOSITE PENNSYLVANIA R. R. STATION
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New York's new hotel truly expressive of the greatest city. 1200 pleasant rooms each with Servidor, bath, circulating ice water and radio provisions.
Rooms from $3.00
General Manager E. G. KILL,
31st STREET 7th AVENUE

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SCREEN GRID
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The New SCREEN GRID SETS
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148-Page Book of Bargains
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Write for this latest book of radio bargains—new, humless, Screen Grid, A. C. all electric; also battery operated sets. All at wholesale prices. Complete sets as low as $15.95.
Chicago Salvage Stock Store
509 So. Wabash Ave., Dept. 131
CHICAGO

Keystone Electric 67 Is Unwired Kit to Meet Price Requirements

(*Continued from page 62*)

2	Small knobs
1	Large knob
1	Roll hook-up wire
1	Length spaghetti tubing
2	Binding posts
2	Tip jacks
1	Pilot light with socket
1	Chassis with sockets ready for wiring, insulating washers, solder, nuts and screws
2	Small brackets
1	Power pack completely wired ready for use
4	Triad, Cunningham or Arcturus 226 tubes
1	Triad, Cunningham or Arcturus 227 tube
1	Triad, Cunningham or Arcturus 171 A tube
1	Triad, Cunningham or Arcturus 280 tube

Note: Jones plug or bakelite terminal strip is optional.

ABC of Radio Department

(*Continued from page 96*)

available, together with new and improved methods of winding.

"The finest work we now undertake is in conjunction with wire-wound volume controls up to 25,000 ohms. Here the wire is about 1½ thousandths of an inch in diameter, as compared with 2 thousandths for the usual human hair. The resistance measures 300 ohms to the foot, and we wind 450 turns per lineal inch. So close are the turns that it requires a powerful magnifying lens to note the clean-cut separation between turns, measuring eight ten-thousandths of an inch. Due to an improved form of pressure, rather than sliding, contact, we avoid all wear and tear on the fine wire."

Leutz "Seven Seas" Console Is Made by Expert Radio Craftsmen

(*Continued from page 59*)

speaker. With the set in operation, it is impossible to hear the slightest "hum" unless the ear is placed right against the speaker grille.

Controls are Simple

The controls are relatively simple. While a single tuning dial control is provided, affording single dial control, this dial is split and each side can be adjusted individually if required. This feature permits adjusting the split dial for the proper setting for the particular aerial used and is a decided advantage over a strict single dial.

A control is provided to regulate the sensitivity of the radio frequency amplifier, by varying the screen grid bias voltage. This provides an absolute control of the sensitivity so that it can be increased to a maximum for great distance work. A second control regulates the grid voltage as supplied to the first audio stage. This volume control prevents overloading the first audio tube by local signals of great strength which would exist even with the sensitivity control at a minimum.

The present cabinet used for the Seven Seas is made by Aston, accepted as the highest grade radio cabinet made today, and while it adds to the price of the receiver, the superior construction insures permanence and the general appearance is most attractive. The Seven Seas is also produced in the same cabinet with a phonograph drawer at the bottom. This contains the electric phonograph motor, turntable, pickup and control switches. Only a simple two way switch is required to change from radio to records. The use of this pickup and the superior audio amplifier in the Seven Seas allows the reproduction of phonograph records equal in quality to the most expensive electric phonographs. The Seven Seas is also available in more elaborate cabinets, suitable for large residences or yachts.

The Leutz organization is now in its ninth year and its continued success has been due to many important factors. As a result the Leutz product appeals to a class of buyers who demand and can afford the best. A list of the Leutz customers includes some of the biggest business executives and wealthiest men in this country and a good number in foreign countries. Almost 25 per cent of the Leutz receivers are exported to foreign countries where maximum results and freedom from service are both very essential.

Lincoln 8-40 Super Now Designed for 224 A. C. Screen Grid Tube

(*Continued from page 66*)

tively, the idea is immediately suggested to tune the primary.

The effect of the shield is to greatly increase the plate to filament resistance from a value of less than 20,000 ohms to a value in the order of 500,000 ohms. With the three-electrode tube it was not very difficult to get a primary impedance at least equal to the plate to filament resistance of the tube.

A tuned secondary transformer which was satisfactory for the three-electrode tube having a primary impedance of possible 50,000 ohms would give very little gain when used with shield grid tubes because of the very small proportion of the total plate circuit impedance which the primary of the transformer would represent. A tuned primary would, however, have a very high impedance and would make it possible to get a much larger proportion of the voltage generated in the tube across it. It is evident that, if the primary impedance of the transformer was equal to the plate to filament resistance of the tube, that only one-half of the voltage would appear across the primary. From these considerations, it is easily seen that the primary of a transformer used with shield grid tubes must be tuned.

In the case of the shield grid tube, the plate to filament resistance is so high that its effect upon the tuned primary in producing an equivalent series resistance is negligible. This means that there would be no loss in selectivity in tuning the primary, but a considerable increase in voltage amplification would be effected.

After determining that the primary of the transformer must be tuned there is still left one remaining possibility, namely, tuning both the primary and the secondary. Tuning the secondary, of course, would eliminate the short circuiting effect of the input capacity of the tube. When both the primary and secondary are tuned a maximum transfer of energy no longer takes place with close coupling. The condition for maximum transfer of energy is, to the contrary, a very loose coupling. Since space limitations eliminate the possibility of separating the primary and secondary by a space of 6 or more inches, depending upon the type of coil used, it was necessary to turn one of the coils so that it was practically at right angles to the other. It was found, however, that there is no such thing as perfect shielding. The gain which can be obtained with the tuned primary transformer is more than can be successfully used. The tuned primary transformer gave a gain of 75 per stage at a frequency of 475 kilocycles with complete copper shielding and by-passing. It was found, however, that this gain had to be reduced for stable operation. For this reason the tuned primary and secondary transformer was found to offer no advantages, from a standpoint of the amount of amplification which could be used in the set, and, had the distinct disadvantage of an additional adjustment for each stage.

Thordarson Transformers and Chokes

For Use With

"245" Type Power Tubes

and

"224" Screen Grid Power Detectors

Input Couplings

Single "245" tube, from any radio amplifying tube, use any one of three transformers (R-400 especially suited to "226" and "227" tubes)	R-260 R-300 R-400	**$5.00** **8.00** **9.00**
Push-Pull "245" tube, from any audio amplifying tube. Use 1-to-1 ratio input transformer	T-2408	**$8.00**
Use 2-to-1 ratio input transformer	T-2922	**12.00**
Screen grid power detector "224" to any **single** power tube, use "Autoformer" for choke-resistance type of standard circuit	R-190	**$5.00**
Screen grid power detector "224" to any **push-pull** power tubes use R-190 Autoformer for parallel feed to detector plate and 2-to-1 coupling transformer	T-2922	**$12.00**

Speaker Couplings

Single "245" tube to dynamic speaker with built-in transformer, to cone speaker, or to magnetic speaker—Use either one of two transformers	T-2876 T-2901	**$ 6.00** **12.00**
Use choke-condenser coupling, employing one choke	R-196	**5.00**
Single "245" tube to moving coil of dynamic speaker—Use transformer	T-2902	**$12.00**
Push-pull "245" tubes to dynamic speaker with built-in transformer, to cone speaker, or to magnetic speaker—Use coupling transformer	T-2880	**$12.00**
Use choke coupling, employing double choke	T-2420	**8.00**
Push-pull "245" tubes to moving coil of dynamic speaker—Use either one of two transformers	T-2629 T-2903	**$10.00** **12.00**

Filament Supplies

For six **"224"** screen grid tubes **or six** "227" tubes —Use filament transformer (10.5 amps at 2.5 volts)	T-3660	**$9.00**
For two "224" tubes **or** two "227" tubes **and** one or two "226" tubes use double voltage transformer	T-3081	**$6.00**

Power Compacts

For filament current, plate current and bias on **"245" push-pull power stage,** also plate current for set. Contains filter chokes. Uses one 280 rectifier tube	R-245	**$24.00**
For filament current, plate current and grid bias on **single "245" power tube** and one "226" audio tube, also plate current for set. (Requires extra T-3081 filament transformer.) Contains filter chokes	R-480	**$17.00**

THORDARSON
RADIO
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Thordarson Electric Manufacturing Co.

Transformer Specialists Since 1895

WORLD'S OLDEST AND LARGEST EXCLUSIVE
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All owners of electric radio sets should have one of these A.C. LINE VOLTMETERS. Tells at a glance the exact voltage of your house line, also serves to warn you of a high voltage which might cause damage. Ideal for the Service Man's Kit.

This high grade Tester, furnished with plug-in cord, finished in Dark Green Crackled Enamel, will be sent absolutely FREE with one (3) Year Subscription to the CITIZENS RADIO CALL BOOK MAGAZINE. Yearly subscription $1.75 per year.

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Yankee
MADE IN U.S.A.

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Here is my $5.25 (Foreign $6.00) for which send me YANKEE LINE A. C. VOLTMETER FREE and enter my subscription to the Citizens Radio Call Book Magazine for three (3) years, starting with the

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This Wholesale Catalog Will Save You Money

Write today for our large illustrated new Catalog "C." Everything new in radio, including the new Screen Grid A. C. humless all-electric sets, as well as battery operated sets, priced as low as $15.95.

ALLIED RADIO CORPORATION
711 W. LAKE ST. CHICAGO

Selectivity Secured

Amplification is of little value unless it is accompanied by selectivity. The intermediate frequency of 475 kilocycles was chosen because the selectivity is much better at a high frequency than at a low frequency, and because this frequency gives one spot reception. Selectivity is determined not only by the frequency of the intermediate but by the ratio of the inductance of the tuned circuit to the tuned circuit resistance. At a frequency of 475 kilocycles it was found that a single layer solenoid was the highest ratio of inductance to effective resistance of any type of winding. For this reason solenoids for both primary and secondary are used.

The final conclusions were that for maximum usable gain the tuned primary transformer using single layer solenoids for both primary and secondary coils mounted in fully enclosed copper shielding and operating at a frequency of 475 kilocycles, gave maximum amplification combined with maximum selectivity.

Scott Gives an Impetus to Custom Building with His New Set

(*Continued from page* 56)

may be an occasional case of hum which is due to the linkage between the power pack and the receiver. Therefore, the power pack should not be placed directly under the right-hand end of the receiver but should be placed under the left-hand end. In the event hum is still not eliminated, the operator may place a fairly large sheet of copper or aluminum on the floor of the cabinet and under the power pack, running a wire connected from the sheet to a good ground.

Ready to Operate

A full set of instructions is furnished with each of the receivers and these instructions have been followed out in adjusting the receiver to maximum efficiency in our laboratories. Inasmuch as the receiver comes fully wired, it has not been felt necessary to include a list of parts. According to advice from the makers of the receiver, the set is supplied with tubes and speaker so that everything required for the operation of the receiver may be secured from the Scott organization.

Remler Produces New Design in Type "111" Receiver and Supply

(*Continued from page* 68)

receiver. The combination of the band-selector circuit and the special type of transformer coupling employed in the "111" results in an ideal co-ordination of sensitivity, selectivity and uniformity of frequency amplification. Freedom from attenuation of the higher audio frequencies allows a brilliance of reproduction otherwise not obtainable.

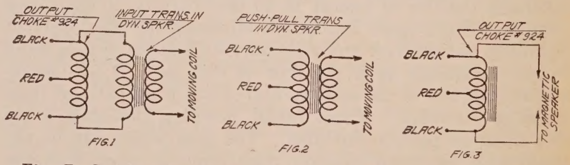
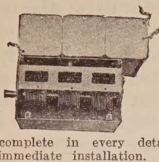


Fig. 7. In this sketch are illustrated three methods of output coupling for use with a dynamic speaker. The first and second figures are for dynamic types of speakers while the third figure is for the use of magnetic speakers

The gang-condenser is held in construction to an accuracy of ¼ of one per cent on a frequency basis. Balancing condensers are provided so that the various circuits can be accu-

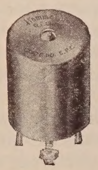
(*Continued on page* 134)

3-STAGE BAND FILTER *and* R. F. AMPLIFIER UNITS



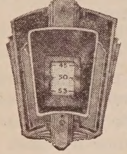
Completely wired, shielded and tested. Band Filter for 10-kilocycle selectivity. Flat-top tuning without side-band cutting. S. G. Amplifier for amazing amplification of 3 Screen-Grid tubes. Both units complete in every detail, except tubes, for immediate installation.

SHIELDED POLARIZED R. F. CHOKE



A radio-frequency choke specially developed for modern high-gain shield-grid receivers. Aluminum-shielded and polarized. Minimum external field. No undesired coupling to cause circuit instability or feed-back. High inductance, low distributed capacity. Efficient, compact.

New DRUM DIAL PANEL PLATE



Richly embossed, pebbled bronze, in the modern mode. It has grace and charm appropriate to the superb dial mechanism back-panel, that delighted thousands of set builders last season. The control knob can be mounted **anywhere** on the panel. Illuminated scale.

NEW!

Members of the Famous HAMMARLUND *Family of* PRECISION PRODUCTS

Each year, as Hammarlund facilities grow and Hammarlund reputation for quality is more firmly entrenched, new aids to the radio builder are presented.

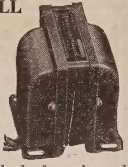
Here are five of Hammarlund's latest perfected devices, in addition to the famous "Midline" Condenser, which has never been surpassed since its introduction more than three years ago.

The Hammarlund policy of progressive conservatism is your assurance of scientific accuracy and finest workmanship in any product bearing the Hammarlund imprint.

For Better Radio
Hammarlund
PRECISION
PRODUCTS

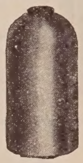
Write Dept. CB9 for folders

AUDIO TRANSFORMERS *Including* PUSH-PULL



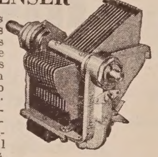
Designed for fidelity of response over the audible frequency range with a sharp cut-off at the high frequency noise level. Large cross-section core of specially treated laminations permits high primary currents without saturation. Completely shielded. Pigtail terminal leads for sub-panel connection.

SCREEN-GRID TUBE SHIELD



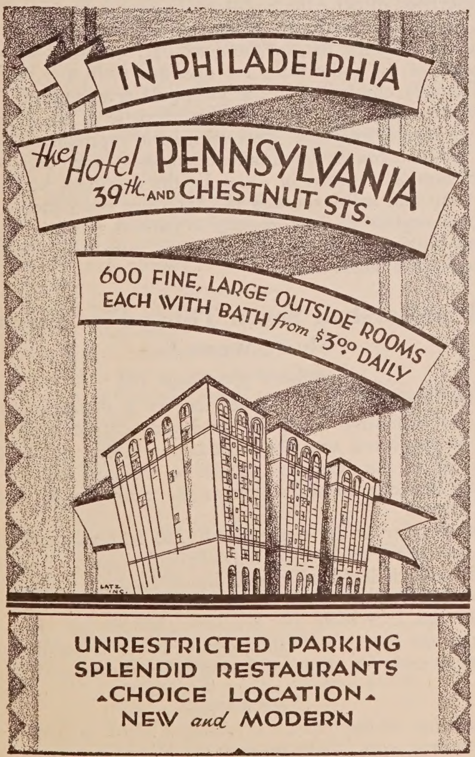
Essential for '22 and '24 type shield-grid tubes to insure full advantage of their great amplification. Aluminum, with a soft rubber grommet at top to protect control grid outlet. Designed for use with sub-panel sockets. Mounting screws and control grid connector included with each shield.

The Famous "MIDLINE" CONDENSER



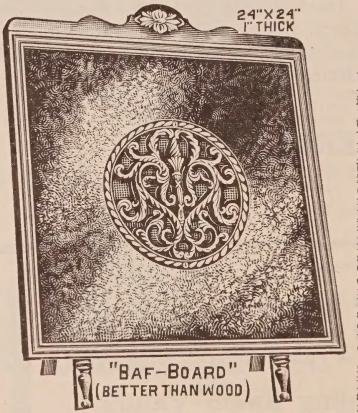
More than three years the favorite of engineers and advanced radio fans —and still new in the sense that its features and workmanship from the beginning were so far ahead that its popularity has steadily increased and its leadership still stands unchallenged. All standard capacities.

HAMMARLUND MANUFACTURING CO.
424-438 W. 33rd Street, New York



Lifetime DeLuxe Baffle Board

(Ideal for Finest Tone)



PRICE $12.50

FILLS the need of demand for extra speaker in various rooms. Ideal for dual or remote control. Completely finished with adjustable shelf for mounting Dynamic or Magnetic speaker. Easel back can be folded flat if board is hung up. Special water-proofed material is heavier and better than wood for tonal quality. Recognized by world's leading acoustical engineers as the ideal material for most perfect tone. One of the most recent discoveries of radio engineers seeking ideal baffle board was that back and sides of baffle should be open—thus giving better tone than is possible in closed cabinets.

Antique brown finish is fine enough for best homes, having beautiful scroll backed by silk. The most perfect baffle for any size dynamic speaker due to less inherent vibrations and causing purity of tone never equalled. Absolutely non-rattle because of elimination of all vibration hang-overs (harmonics). Positively will never warp even if soaked in water. A thing of beauty as well as efficiency.

Weight 14 lbs.; packed in individual shipping carton 24½ x 3 x 30¼

PLAIN BAFFLE BOARD, 24" x 24"—1" Thick: Furnished complete with easel, grille, shelf and 8" hole. Packed in individual shipping carton. Plain finish and without wood border moulding. Price.... **$10.00**

THEATRE SIZE OR PUBLIC ADDRESS SYSTEMS: 36" x 36"—1" Thick: Plain finish and without wood border moulding, Price........ **$12.50**

THOROLA RADIO PRODUCTS 1014 S. Michigan Ave., Chicago, Ill.

SET BUILDERS and DEALERS

Send for ROYAL-EASTERN'S NEW 124 page 1930 General Wholesale Catalogue

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Every worth while radio, electrical and sporting goods item is featured at lowest wholesale prices. Being the largest Radio and Electrical Mail Order House in the East, we can serve you best. We buy no seconds. We have no job lots. Only fresh and clean products in original factory cartons.

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Service Testing Instruments

FOR the past several months the engineers of the General Radio Company have been developing three new instruments for the radio serviceman's laboratory. As soon as the final inspection tests have been completed, descriptive literature will be sent to all those who have requested it.

The new apparatus will supplement the line of GENERAL RADIO SERVICE-TEST INSTRUMENTS, which includes a direct-reading ohmmeter, a capacity meter, and a mutual-conductance meter. The latter tests screen-grid tubes as easily as it tests triodes, with no changes in the internal connections and with no special attachments.

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rately lined up. These are adjusted at the factory. Volume is controlled by means of a 100,000 ohm variable resistor which governs the voltage applied to the shield-grids of the radio frequency tubes.

The a. c. shield-grid power detector is of the grid-bias type. The principal advantage of the power detector is that it provides an output voltage sufficiently high that the audio amplification necessary is lessened. A smaller degree of audio amplification means less noise and greater freedom from distortion. The grid-bias type of detector acts as a radio frequency amplifier, since rectification takes place in the plate circuit, while the grid-condenser, grid-leak detector acts as an audio frequency amplifier. The extra radio frequency amplification provided by the grid-bias detector reduces still further the amount of audio amplification necessary. The power detector provides linear detection with its freedom from harmonic distortion.

The power detector is resistance-coupled to the first audio tubes. Resistance coupling provides the high external plate circuit load necessary for adequate voltage transfer from the shield-grid tube. It has, moreover, an essentially flat frequency characteristic over the full band of audio frequencies. The large detector output voltage makes the voltage step-up ratio which might be supplied by a transformer unnecessary.

Parallel First Audio

Two 227 heater tubes are used in parallel in the first audio stage because of the improved frequency characteristic which they provide and because of their ability to handle more power than a single tube. The plate impedance of tubes in parallel are in parallel so that the effective tube plate impedance presented to the external circuit is equal to half the impedance of a single tube.

The advantages of push-pull amplification are pretty generally recognized. Tubes in push-pull are capable of in the neighborhood of twice the undistorted power output of a single tube. Distortion due to even harmonics is eliminated as these harmonics balance out in the push-pull circuit. When the filaments of the audio tubes are operated from a. c. the hum is effectively eliminated in the push-pull arrangement.

The overall audio frequency characteristic of the type 111 receiver is most excellent. There is natural reproduction of the bass with consequent depth and roundness of tone and yet the higher musical resistor, in which lie the overtones which provide snap and brilliance and natural voice reproduction, has not been neglected. Reproduction is natural and true and the volume obtainable without distortion is more than ample for the home or a small hall.

Silver-Marshall Seven Thirty-Five Electric Short Wave Set

(*Continued from page* 70)

that the push-pull input transformer of a dynamic may be used, or if desired a regular push-pull output transformer may be employed with its secondary winding going to the voice coil of the dynamic. It will be observed that the field for the dynamic speaker becomes the choke in the rectifier filter system.

The rectifier is the conventional 280 full wave supplying high voltage for the receiver and filament supply for all tubes. A 275 choke is included in each leg of the high voltage transformer going to the plates of the 280.

Although four coils are supplied with the kit, these coils covering the short wave band, nevertheless it is possible to get two extra coils for covering the American broadcast band.

Coil Ranges

The range of the lowest coil which is 131-L is from 17.4 to 32.1 meters; coil 131-M tunes from 31 to 58 meters; 131-N covers from 57 to 110 meters, while 131-O takes in wavelengths lying between 104 and 204 meters. The lowest broadcast coil is 131-P and ranges from 190 to 358 meters while the top coil is 131-Q and takes in stations from 344 to 647 meters.

On account of the great amount of broadcasting now done on short waves, it may be interesting to readers to know of some of the possibilities available for entertainment at the present time. Among the broadcasting stations whose programs are available on short waves may be found W6XM of the General Electric at Oakland, California, which has recently gone on the air on 23.35 meters, simultaneously broadcasting the KGO programs. This station may be picked up on the 131-L coil. In addition to that this same station is also licensed to transmit television signals on 145 meters and can be picked up on coil 131-O. Station W2XE at Richmond Hill, N. Y., transmits on 58.5 meters while W8XAL broadcasts the WLW Crosley programs from Cincinnati on 52.02 meters. The first mentioned station may be picked up on coil 131-N while the second mentioned can be found on coil 131-M. Another very consistent station is the General Electric transmitter at Schenectady, W2XAF, on 34.68 meters.

Foreign Stations

Among the foreigners there are three stations that are better known and consistently received by short wave enthusiasts. The first is 5SW at Chelmsford, England, transmitting on 24 meters, but rather irregularly, who can be picked up on coil 131-L. Station 2ME at Sydney, Australia, has been heard on the same coil, his wavelength being 28.5 meters. Another foreigner heard quite frequently is PCL at Eindhoven, Holland who transmits on 31.4 meters. This station will also be found on 131-L.

Official Parts List

Parts used in the assembly and wiring of the 735 receiver described briefly are shown in the list below:

1	S-M 721 pierced metal chassis on power unit case
1	S-M 812 escutcheon
1	S-M 810-R right illuminated drum dial
1	S-M 314 .00014 mfd variable condenser
1	S-M 342-B .000075 mfd midget condenser
4	S-M plug in coils 131-L, 131-M, 131-N, 131-O
2	S-M 636 tube shields
1	S-M 260-U audio transformer
1	S-M 270-U push-pull input transformer
1	S-M 336-U power transformer
2	S-M 275 r. f. chokes
3	S-M 277 r. f. chokes
1	S-M 338 filter choke
2	SM 817 wood knobs
1	Potter 674-C condenser block
2	Potter 30-B bypass condenser blocks
1	Polymet .00015 mfd small moulded bakelite condenser
1	CR-224 socket
3	CR-227 sockets
2	CR-245 sockets
1	CR-280 socket
1	H & H 1561 "on-off" switch
3	Yaxley 422 insulated tip jacks
2	Yaxley 840-C 40 ohm center tapped resistors
1	Durham 2000 ohm 1 watt resistor white
2	Durham 10,000 ohm 2 watt resistors green
1	Durham 2 megohm 1 watt resistor red
1	Carter RU-400 400 ohm resistor
1	Carter 2-A closed circuit jack
1	Ohio Carbon 800 ohm 5 watt resistor green
1	Cord and plug
4	Moulded binding posts
1	Set of hardware and hook-up wire

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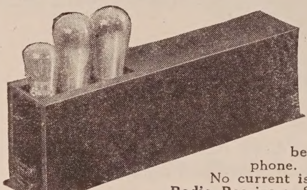
For Use with Radio, Phonograph or Microphone

WEBSTER power amplifiers are manufactured in a variety of models to suit almost any requirement. Whether the purpose be simply to improve the volume and tone of a home radio set, or whether it is desired to provide music and speech through a series of speakers to great crowds of people in theaters or other public gathering places, Webster amplifiers will supply the necessary amplification to radio set, phonograph, or microphone with marvelous accuracy.

These instruments are the product of a company having fifteen years manufacturing experience in radio and electrical lines. Webster has always specialized in audio systems and power supply units. The present line of Webster power amplifiers reflects this background of experience and engineering skill in splendid performance, attractive appearance, and remarkable dependability.

W-245



The Webster W-245 is a two stage transformer coupled amplifier. The first stage is a 227 tube, the second stage is a 245 tube.

A true input and output transformer are used in this amplifier.

Microphone: This amplifier may be used with a single button microphone.

No current is supplied for microphone.

Radio Receiver: Special instructions supplied with the amplifier.

This amplifier is primarily designed for electrifying a phonograph or replacing the audio amplifier of Radio receiver.

May be used wherever a small compact amplifier is desired.

Price: $42.50

WEBSTER "SUPER B" ELIMINATOR

DETECTOR
AMPLIFIER

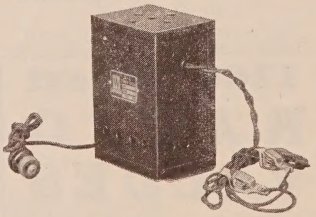
Webster "Super B" is designed for use with Raytheon tube and delivers, under normal load, 75 to 180 volts on the power tube tap. This unit has three variable controls—Detector, Amplifier, and Power.

There are four binding posts, one each for negative B, Detector, Power and Amplifier. To meet the requirements of any receiver drawing up to 60 milliamperes, with five tubes or more and power tube in last audio stage, Webster "Super B" stands unequalled.

This unit delivers sufficient surplus current with wide range of smooth, positive, variable control in the power amplifier tap as well as in the detector and intermediate taps, thus, the B supply may be adjusted to the exact needs for best reception.

Price (less tube) $24.00

WEBSTER DRY BATTERY CHARGER



Webster Charger is designed for use with two B-L dry rectifiers having a tapering charge of 7 amperes.

This charger is built for the most rugged service required and adaptable for radio and automobile storage batteries.

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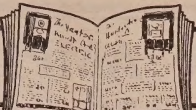

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"The Big Friendly Radio House"

128 West Lake Street Chicago, Ill.

Power Amplification Department

(*Continued from page* 79)

baffles, one to accommodate a single speaker and the other to accommodate two speakers, are among the items designed by this firm for the theater owners. In addition there are two horns being produced, the one shown in Fig. 9 having a flare on both sides, while another model has the bottom flare only.

Due to its directional effect, one of the new horns is pronounced excellent for overcoming poor acoustics in a theater and is also used for reaching certain locations in a large theater which are so distant as to make it otherwise impossible to distinctly hear the reproduction from the baffle alone.

This horn is 48 in. long and the opening at the bell is 30 in. by 21½ in. It has considerable flare and is made from non-resonant material, held together by metal strips. The chassis compartment is weatherproof and dustproof.

Resistor Phone Plug For Power Audio Systems

BY means of an ingenious metallized resistor built into the shaft of the usual 'phone plug it now becomes possible to plug a pair of ordinary radio 'phones into any jack of a power audio system. This idea, which has been patented by the International Resistance Company, simply calls for a metallized resistor filament in place of the usual brass rod passing through the center of the 'phone plug shaft for making the connection with the tip. The metallized filament reduces the voltage applied on the 'phones to a safe value so that satisfactory operation is obtained even on power audio systems designed to operate scattered loud-speakers at high voltage.

Applying Best Pickup to Various Amplifiers

IN applying any electrical pick-up to an amplifier the matter of impedances is a very important one and cannot be neglected if best results are to be obtained. The input circuit of an amplifier may be any impedance, depending entirely on the input transformer, or if resistance coupled, on the resistance used. Likewise the impedance of pick-ups vary between wide limits.

The Best theater pick-up, on account of its size and consequent large winding space, can be wound to a wide range of impedances, running from a few ohms to an impedance sufficiently high for direct connection to the grid of the first stage tube in the amplifier. The Best theater pick-up can be furnished with a winding of any impedance in this range, for use with special amplifiers. As commonly furnished it is wound to a relatively high impedance, so that the pick-up can be coupled to the amplifier through a standard good grade 3:1 ratio first stage audio transformer, or even be operated directly into the grid circuit of the first tube of the amplifier.

Proper Coupling Vital

A number of amplifiers are now being built for theater use with either a 200 ohm or a 500 ohm input circuit. It is entirely unfair to attempt to operate a high impedance pick-up such as the Best theater pick-up directly into the input terminals of such an amplifier. It is just as unfair to attempt to operate a very low impedance pick-up directly into the grid of an amplifier. In each case the proper impedance-coupling transformer must be used.

In order to properly operate a Best theater pick-up on an amplifier with a 200 or 500 ohm input circuit an additional coupling transformer with an impedance ratio of approximately 10,000 to 20,000 ohms primary, to 500 ohms secondary

(*Continued on page* 138)

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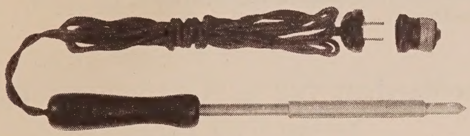

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Write us the conditions which you must meet and we will advise if stock or special FERRANTI Transformers are needed. Special Transformers produced in 48 hours after receipt of order.

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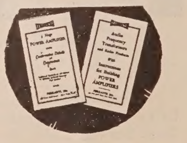

If you are building or thinking of building Power Amplifiers you absolutely need FERRANTI'S New Power Amplifier Book. Contains Diagrams and Components for 10 different, better 2 and 3-stage Power Amplifiers; also much valuable information on Matching Impedances, How to Secure Natural Tone Balance and other important subjects. Sent for 15c. coin, to partly cover cost and mailing.

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Aerovox mica condensers are the standards of the industry. A complete line of resistors for every requirement includes Pyrohm vitreous enamelled resistors in fixed and tapped combinations, Lavite non-inductive resistors, Metalohm grid leaks, wirewound grid suppressors and center-tapped resistors in all standard and special values.

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(*Continued from page* 136)

must be used between the pick-up and the amplifier input terminals. The American Transformer Company, transformer No. 806, is excellent for this purpose. Should this coupling transformer not be available, replacing the low impedance primary input transformer of the amplifier by any good grade of 3:1 ratio audio input transformer will provide the ideal working conditions for the Best theater pick-up. As a second means, which, however, gives fairly good results, simply leave the input terminals of the amplifier open and connect the pick-up directly to the secondary terminals of the input transformer in the amplifier.

When the amplifier has a low input circuit preferably a pick-up specially wound with an impedance for that amplifier should be used. By all means, do not attempt to judge the quality of reproduction, or the behavior of the pick-up, when it is incorrectly coupled to the amplifier.

Silver-Marshall 722 Is Band Selector Using Screen Grid Tubes

(*Continued from page* 50)

also varies greatly so that it is desirable to work out of a low impedance into a low ratio transformer to minimize the loading effect of the power tube.

Power Pack on Chassis

The 224 screen grid power detector feeds through a resistance coupler to a 227 first audio tube, which through a special low ratio input transformer feeds the 245 tubes in push-pull.

The ABC power supply consisting of power transformer, filter choke, condenser and necessary voltage dividing resistors is mounted at the left end of the receiver chassis. The 722 receiver is intended to oprate with the S-M 851 or equivalent dynamic speaker, and has provision for furnishing all desired field power to the speaker, the field of which is used as a choke in the power supply filter circuit. The 722 receiver may be either had as a chassis equipped only with the 812 escutcheon, or it may be mounted in the new S-M 707 metal table cabinet. A walnut finished and pierced metal panel for adapting the 722 to standard consoles is also available.

The photograph shown in Fig. 1 gives an idea as to the layout of the receiver. It should be noted that the radio frequency end of the set is shown with the top removed. Individual trimmer condensers are provided on each section of the gang condenser so that the gang can be lined up on a given signal. Adjustment should be made while the cover is on, there being holes provided in the top of the cover for reaching the trimmers.

Overall Gain High

The overall gain of the receiver is excellent and indicates not only high sensitivity but a good gain ratio over the broadcast band as well. The actual selectivity is considerably higher than that of a similar receiver using straight tuned radio circuits. The improvement in selectivity is particularly noticeable on local stations and brings out the benefit of the "Siamese" circuit as is used here.

The electrical circuit of the receiver is illustrated in Fig. 4, which is the schematic diagram. The receiver is completely assembled upon the 721 formed and pierced steel chassis, while the r. f. tubes and three sections of the gang condenser are shielded by the 723 shields. The same band selector found in the 712 receiver of the S-M line is used in the 722 between antenna and r. f. amplifier. This selector, in combination with a new and highly efficient r. f. transformer, coupling the r. f. tubes to each other and to the detector, actually results in appreciably more amplification obtained from two r. f. stages in the 722 than are obtained from three stages in other screen grid receivers.

The chassis is not used as a ground return in the r. f. circuits. All of the points which are at ground potential are brought back to one particular point in each stage. Even the die cast frame of the condenser is so constructed that the interstage shield is shunted to the rotor between the various sections to prevent there being any common coupling impedance in the rotor of the condenser. While these precautions seem unusually elaborate to anyone who has worked largely with the 226 and 227 tube in r. f. circuits and with low gain r. f. stages, they are found absolutely necessary in the design of a high gain receiver.

Official Parts List

Parts used in the construction of the S-M 722 receiver are shown below:

1	S-M 721 pierced metal chassis and power unit case
1	S-M 812 escutcheon
1	S-M 810R (right) illuminated drum dial
1	S-M 322 .00035 mfd. four-gang condenser
1	S-M 723 three-compartment shield
1	S-M 122 shielded r. f. coil
2	S-M 123 shielded r. f. coils
1	S-M 124 shielded r. f. coil
1	S-M 336-U power transformer
1	S-M 338 filter choke
3	S-M 275 r. f. chokes
1	S-M 270-U push-pull input transformer
1	S-M 30X selector coupler
1	S-M 818 hook-up wire
1	Potter 674-C condenser block
2	Potter 30B by-pass condenser blocks
3	C-R 224 tube sockets
1	C-R 227 tube socket
2	C-R 245 tube sockets
1	C-R 280 tube socket
1	Yaxley 10MJP 10,000-ohm potentiometer
2	Yaxley 840C 40-ohm center-tapped resistor
3	Yaxley 422 insulated tip-jacks
1	Durham 2,000-ohm one-watt resistor (white)
2	Durham 10,000-ohm two-watt resistors (green)
1	Durham 25,000-ohm one-watt resistor (black)
1	Durham 60,000-ohm one-watt resistor (blue)
1	Durham 300,000-ohm one-watt resistor (yellow)
1	Durham 2-megohm one-watt resistor (red)
2	Polymet .00015 small moulded condensers
1	Polymet .006 large moulded condenser
1	H & H 1561 on-off switch
1	Carter 2A closed circuit jack
2	Carter RU 400—400-ohm resistors
1	Ohio Carbon 800-ohm three-watt resistor (green)
2	1⅛-in. R. R. brown wood knobs
1	Cord and plug
5	Moulded binding posts
1	Set of hardware

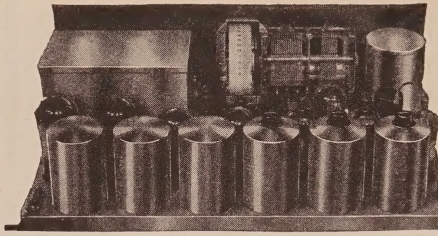
WITH THE ACCESSORY AND PARTS MANUFACTURERS

(*Continued from page 129*)

thus quickly and accurately checked on the instruments of the 199 and recorded on the handy radio set analysis sheet. Results of the test are checked against data covering the receiver given in the instruction and data book which contains data on receivers of leading manufacturers.

The Jewell pattern 199 provides every test required for effective radio servicing. It tests a. c., d. c. and shielded grid

BRAXTON-KING



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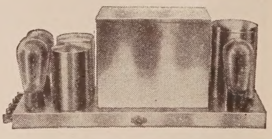

The Braxton-King Push Pull Power Amplifier is also sold separately. It employs two 245 tubes in Push-Pull and one 280 rectifier. Will deliver 4.5 watts of undistorted energy to the speaker. Also supplies B power for the set and filament current for six 227 or 224 tubes. **Price, $55.**

SET BUILDERS. Regular Set Builders' discount applies on the new Braxton-King Screen Grid Super

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Filtrols are scientifically designed to **protect** your set against noises from electrical apparatus coming over the AC line.

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To find out if your trouble is AC line noise, disconnect the aerial and turn the set up to full volume. If noise still continues you need a Filtrol. If there is no noise with aerial disconnected, your trouble is not from the AC line.

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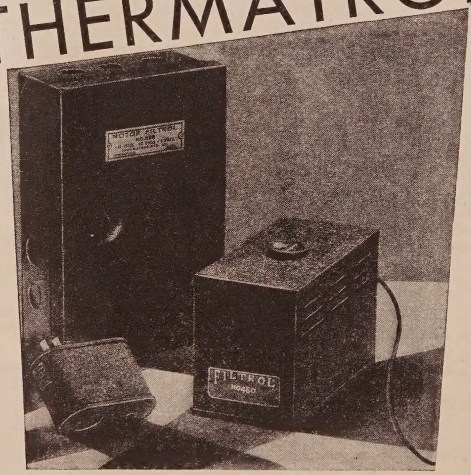


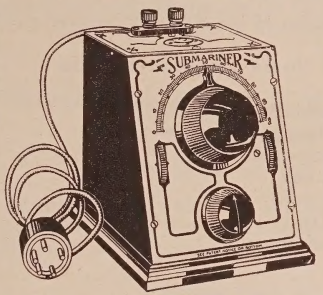
Thermatrol Mfg. Co.

52 Willow St. Springfield, Mass.

tubes, A and B eliminators, batteries, circuits, grid, plate and cathode voltages, plate milliamperes, chargers and line voltage. Ranges of instruments are: 0-4-8-16-160 a. c. volts, 0-7.5-75-300-600 d. c. volts and 0-15-150 milliamperes. All d. c. voltage ranges have a resistance of 1000 ohms per volt. The unit is furnished with test leads, four and five-prong tube adapters, line voltage leads, pad of analyzer charts and complete instructions.

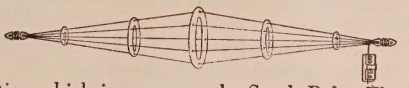
J-M-P "Submariner" Enters Its Fourth Radio Year

THE "Submariner" Short Wawe Adapter illustrated here enters the fourth year with many improvements and refinements. These adapters are available for use attached to all receivers, both a. c. and d. c., including super-heterodynes, tuned r. f., screen grid, and those employing power detectors. One of the refinements incorporated in the new models, is the vernier adjustment for fine tuning, having a ratio of 64 to 1. This is accomplished by a worm drive operated by a small knurled disc at the side of the dial. An improvement known as the "J" feature, gives the "Submariner" an output in volume five times greater than any other short wave adapter. Fixed wave band, as well as interchangeable coil models, covering any wave length, are available. In all, there are over 16 types for every possible receiving set.



DX Aerial on Byrd Tests

AMATEUR Experiment Station W9US in Illinois (using short-wave outfit), uses a No. 60 Lifetime DX aerial, and No. 30 Lifetime DX aerial for lead-in. This well-known amateur station talks almost nightly with the Byrd Expedition which is now near the South Pole. They have tried many different arrangements to get the most efficient aerial in order that they could receive important messages, regardless of conditions. This station handles all of the middle-west messages for the Byrd Expedition and sometimes are in communication for two hours at a time.



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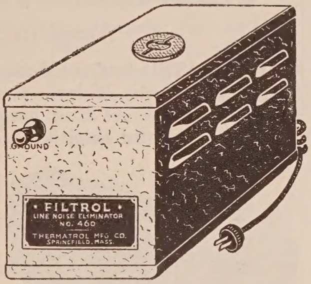
Amperite Makes Line Control for A. C. Receivers

THE new Amperite self-adjusting line control made by the Radiall Co., 50 Franklin St., New York City, N. Y., and illustrated in this column is constructed in a glass bulb form, with rugged resistance unit insuring constant and instantaneous response to even slight fluctuations in the line voltage. There are no moving parts. Control is provided with the UX type base with only two prongs, these contacts connecting directly in series with the line or power transformer. For general radio purposes the controls are designed to handle line fluctuations of about 30 volts (95-125) and to regulate current or voltage to a constancy of within 10 per cent over this range. Many of the present day a. c. sets are provided with a socket for the Amperite so that accurate voltage control may be secured.

AMPERITE
Self-Adjusting
LINE VOLTAGE
CONTROL
AMPERITE
10-20

Thermatrol Announces Line Noise Eliminator

DESPITE all that has been written on the elimination of noise in power lines, service and repair men are finding that there is still ample opportunity for profits in providing line noise eliminators for customers who complain of power interference. One of the models now popular is made by the Thermatrol Mfg. Co. and illustrated here. It plugs ahead of the set and filters out noises coming over the a. c. line. It may be used ahead of appliances drawing up to ¼ HP. and contains specially designed chokes and condensers finely balanced to insure filtering out all line noises. This unit is known as the Filtrol. Another model made by the same concern and designed for circuits ahead of motors, generators, sign flashers is known as the motor Filtrol, with a maximum current of 5 amperes or a maximum load of 500 watts. These items are made by the Thermatrol Mfg. Co., 52 Willow St., Springfield, Mass.



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"The Big Friendly Radio House"
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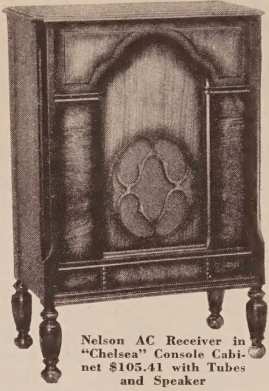
THE NEW NELSON AC Operated Radio Receiver



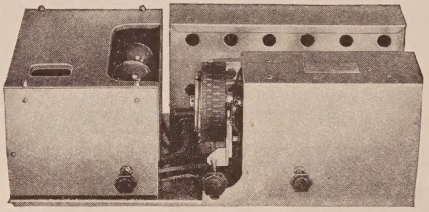
Nelson AC Receiver in "Chelsea" Console Cabinet $105.41 with Tubes and Speaker

THE New Nelson AC Operated Receiver does not just reproduce sound — it mirrors voice and instrument. Booming bass, bell-like treble — it brings in both, etching them sharply against a background of velvet silence. Tuning is accomplished by the new "Selectaphase" System which gives absolute selectivity between stations. Power detection eliminates all possibility of overloading.

When the station you are listening to stops momentarily, you hear no under-current of other broadcasting — only velvety silence. And there are few stations that you cannot get when you want them. Full range of audible sound comes in with uncanny realism; the program lives! Reaches out abnormal distances for programs.

This remarkable receiver is far superior to anything on the market today, when tone quality, range, selectivity, and volume are taken into consideration.

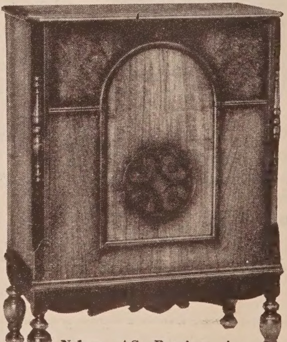
LICENSED UNDER THE TECHNIDYNE PATENTS



Dial illuminated and marked both in numerals and kilocycles. Variable line voltage control. Fuse protection of entire receiver. Power Detection. Push-pull audio amplification using the new powerful 245 type tubes, two in number. Electrical Phonograph Pick-up attachment. Mershon high voltage everlasting filter condensers. Unit construction throughout, complete receiver may be disassembled into two parts without unsoldering a single joint.

SIZE OF CHASSIS ALLOWS USE OF ALMOST ANY CONSOLE CABINET

The Nelson Receiver is available in either chassis form or as a complete receiver mounted in a console. We can supply this wonderful instrument in a beautiful Walnut Console, complete with genuine Jensen Concert Electro-Dynamic Speaker, nine Arcturus AC Tubes and complete antenna equipment for the amazingly low price of $103.93. Other models are also available using more ornate consoles or equipped with phonograph pick-up systems and electric phonograph motors at slightly higher prices. THIS IS THE MOST WONDERFUL RADIO VALUE WE HAVE EVER HAD THE OPPORTUNITY OF OFFERING OUR DEALERS. Send for Special Folder Describing the New Nelson AC Operated Receiver.



Nelson AC Receiver in "Morton" Console Cabinet $109.81 with Tubes and Speaker

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Premium No. 2

WITH A TWO YEAR SUBSCRIPTION TO CITIZENS RADIO CALL BOOK MAGAZINE, we offer FREE, this very fine THERMATROL DYNAMIC SPEAKER CONTROL, for AC sets with separate dynamics. The Dynamic Speaker Control places entire control of the speaker, automatically in the set switch, eliminating the inconvenience of snapping two switches and the danger of leaving the speaker on, when set is off. No wiring, just plug it in the wall outlet—no cords to tangle—takes no table space.

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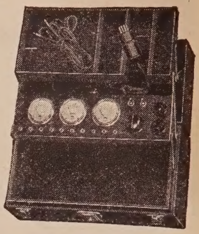
Model 15 Readrite Set Analyzer and Service Kit

MADE by Readrite Meter Works of Bluffton, Ohio, the model 15 set analyzer and service kit combined is illustrated in this column. It embodies new and valuable features. It is equipped with regular adapters and also a new adapter for testing screen grid tubes and a special switch adapter for full wave rectifying tubes. Adapters are also available for Kellogg tubes.

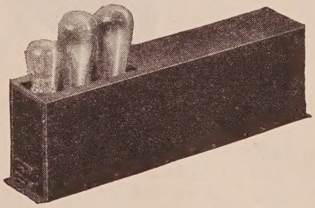


The unit has a triple reading d. c. voltmeter, a double reading a. c. d. c. repulsion type voltmeter and a double reading d. c. milliammeter. Instrument ranges are: d. c. volts 0-60, 0-30 and 0-600; a. c. volts 0-10 and 0-140; milliamperes 0-20 and 0-100. Special tip jack connections permit individual use of these meters for a wide variety of testing, including continuity test of transformers, chokes and condensers.

Compartments for grid leaks, condensers, screws and findings are provided. Space is allowed in the bottom of the case for soldering iron, tools and extra tubes. A single motion opens the case ready for use. The size of the unit when closed is 7 in. by 7¼ in. by 14 in. The metal case is finished in dark brown enamel baked on to insure durability.

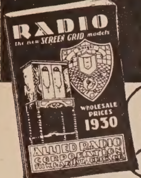
Webster Includes a 245 Model in Its Amplifier Line

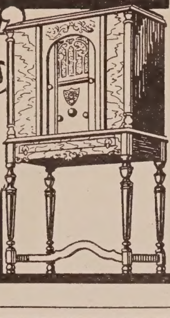
ILLUSTRATED in this column are two of the items manufactured by the Webster Company, 850 Blackhawk St., Chicago, the first item being a type W-245 two stage transformer coupled amplifier. The first stage is a 227 tube and the second is a 245. Input and output transformers are used in this model of the amplifier. The amplifier may also be used with a single button microphone, although no current is supplied by the amplifier for the microphone. The amplifier is principally designed for electrifying phonographs or for replacing the audio amplifier of a radio receiver.



Another item in the Webster line is the Webster Super-B designed for use with the Raytheon tube and delivers under normal load 75 to 180 volts on the power tube tap. Three variable controls are provided, these being for detector, amplifier and power. Four binding posts are used and the eliminator will meet the requirements of any receiver drawing up to 60 milliamperes, using five tubes or more and a power tube in the last audio stage. Voltage control is smooth and positive in the power amplifier tap as well as the detector and intermediate.

DETECTOR
POWER
AMPLIFIER





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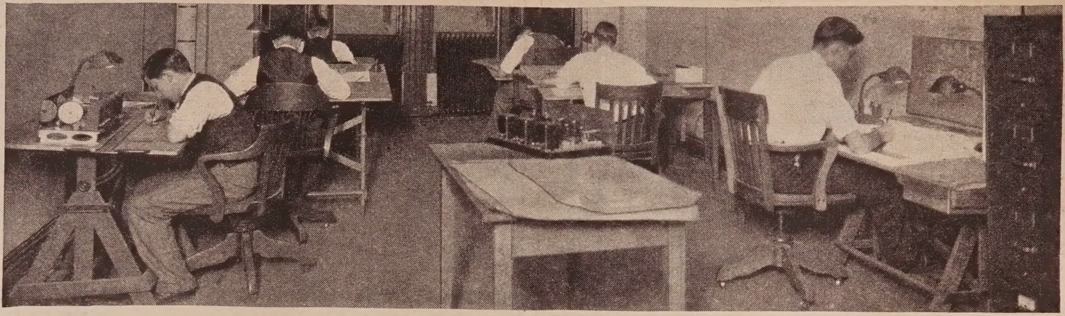

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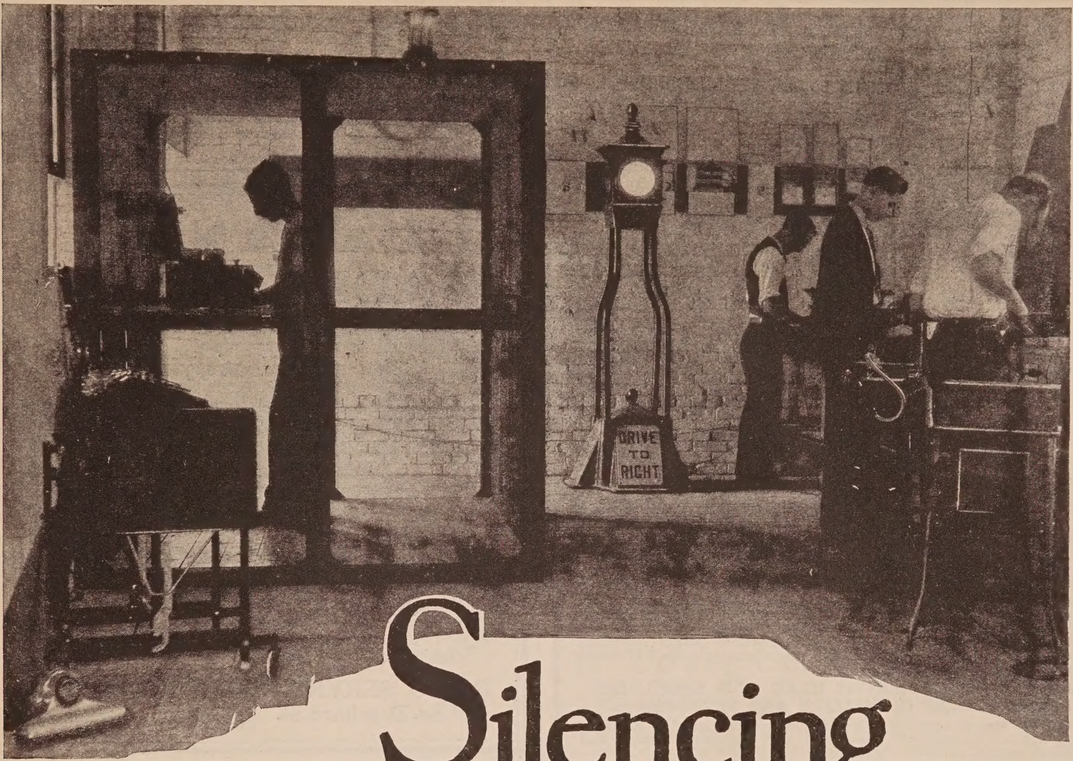

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AMPLION AA-102 GIANT DYNAMIC AIR COLUMN UNIT replaces the former A.C. 100 model

Through new design, we have realized a stronger magnetic field, also due to a revolutionized internal construction, 300% greater volume is delivered at the 5,000 cycle note, than that of the old A.C. 100 unit. These high frequencies make possible quality reproductions of both voice and music heretofore unattainable. (Patents applied for).

AMPLION EQUIPMENT IS HEAD AND SHOULDERS ABOVE OTHERS IN QUALITY AND PERFORMANCE

AMPLION group address equipment has been designed to a standard, not to a price, with the result that marvelous quality and volume, second to none, are realized.

AMPLION builds group address systems to fit any requirement, and **AMPLION** engineers are prepared to cope with any acoustical situation indoors or out, such as found at **railroad depots, county fairs, resorts, race-tracks, football and polo games, skating rinks, auditoriums, hospitals, factories, stores, theatres and hotels.**

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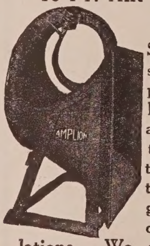

Specially designed to reproduce the human voice and orchestral music in talking picture and group address installations. We also supply Trumpet Horns, recommended for speech only.

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Finest instrument in Europe or America, is equal to the finest scientific instrument made costing four times as much. Designed for hard commercial usage; sturdy in construction. Blasting is practically eliminated and the granular hissing sound is reduced approximately 80% less than other types. Made in three models.

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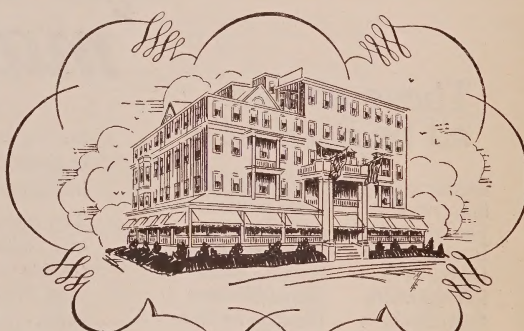

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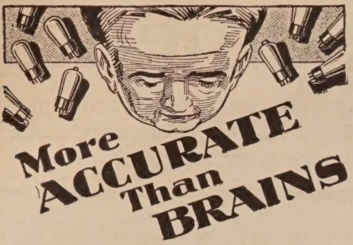

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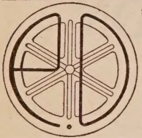

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(Formerly Pohl Brothers)
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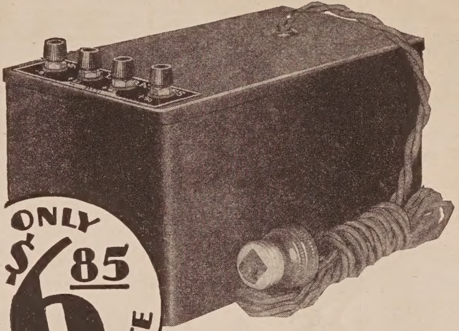

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SEND ONLY $1.00

Fill in coupon and send with only $1.00. Prove this marvelous value to yourself. Use it ten days. Then if it fails to do everything we say, return it and money paid us will be refunded. Make a REAL receiver of your set.

APPROVED and PASSED by the rigid laboratory tests of "Popular Radio" and "Radio News."

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These Have— So Can YOU!

Have used your Eliminator for two years. Very much satisfied. Find it suitable for short-wave reception also.—Jack Savage, Peoria, Ill.

Am using your Eliminator on a Neutrodyne Super 6-tube and find it just as advertised and perfectly satisfactory. — G. Prefontaine, Montreal, Que.

Have used your Eliminator on my Sparton radio for many months, I like it very much and completely satisfied with it.—Harry H. Ward, South Bend, Ind.

Have had very good success with the Eliminator purchased some two years ago and like it very much.—Harvey E. Grose, Wilton Jct., Iowa.

Have had your Eliminator for two years and consider it the best bargain in Eliminators on the market.—Edward Ellison, Anderson, Ind.

I have had wonderful results since using your Eliminator on my 3-tube Harkness "Counterflex." I am able to get on the loud speaker with good volume such stations as Hollywood, Pittsburgh, Shreveport and dozens of others.—G. S. Bagot, Edmonton, Alta.

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I am receiving better results with your Eliminator than I ever received with THREE 45-volt "B" batteries. It is working fine on my Atwater Kent Model 35.—Carl Sporow, Newberry, Pa.

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Have used your Eliminator for over a year and it sure works fine. —Geo. E. Steiger, Toledo, Ohio.

ATTACH ONLY $1.00 TO THIS COUPON

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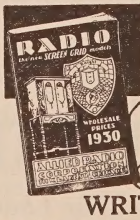

THE NEW SCREEN GRID RECEIVERS

WRITE TODAY

Send for large, new illustrated Catalog "C" showing the latest of everything in radio—featuring the new Screen Grid, A. C. all-electric sets at wholesale prices.

ALLIED RADIO CORPORATION
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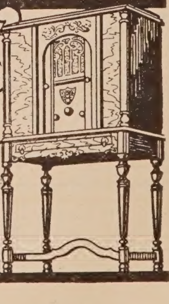

Classified Advertisements

Advertisements in Classified Section, 25 cents per word each insertion, minimum 10 words, payable in advance. Final closing dates, Aug. 10, for September issue; Oct. 10, for November issue; Dec. 10, for January issue; Feb. 10, for March issue. No display or all caps copy accepted.

CUSTOM built radio sets, any nationally advertised kit, at list prices, no construction charge, any cabinet or console. Also rebuilt battery and electric receivers reasonable. All work guaranteed and laboratory tested. H. G. Derlin, 58 Lincoln Ave., Poughkeepsie, N. Y.

WANTED—Men to work with National Radio Service organization. No selling scheme. Radio Doctors, Inc., Dept. C, Essex St., Salem, Mass.

DIES—Light stampings. B. L. Nortwed, Mitchell, South Dakota.

SONG Poem Writers—"Real" proposition. Hibbeler, D67B, 2104 N. Keystone, Chicago.

UNUSUAL Horoscope—Consisting of extensive four-page horoscope and Astro Analysis. Send 50c and birth date. Money refunded if dissatisfied. No stamps. Prof. Bolles, Box 125, Cranford, N. J.

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MEASUREMENT and Calibration Service. Calibration of Amateur Wavemeters: 1 to 5 Points, $0.50 per point calibrated; 5 to 10 Points, $0.40 per point calibrated; 10 to 20 Points, $0.30 per point calibrated; 20 or more Points, $0.25 per point calibrated. Blueprints of Curves: 1 Blueprint, $1.00; 2 Blueprints, $1.50; 3 Blueprints, $1.75; 4 Blueprints or more, $0.50 each; Additional Copies, $0.20 each. Variable Air Condensers: 1 Per Cent Accuracy, $0.10 per point calibrated; .1 Per Cent Accuracy, $0.20 per point calibrated; (Ten points per condenser is usually sufficient). Blueprints of Curves: Same as wavemeter curves. Fixed Condensers: Capacity at 1000 cycles, $0.25 each. Measurement of Fixed and Variable Condensers: Power Factor, Phase Angle and A. C. Series Resistance. Prices on Request. Intermediate Frequency Transformers: Measurement of Resonant Peak Frequency, $0.75 each; Frequency response and static amplification characteristic curve, $1.50 each. (I. F. transformers will not be matched). R. F. Transformers: Pure Inductance, $1.00 each; Apparent Inductance, $1.00 each; Distributed Capacity, $1.00 each; Fundamental Frequency, $1.00 each; Pure Inductance Matched, $1.00 each; Apparent Inductance Matched, $0.50 each. Measurement or Calibration of: Voltmeters, Microvoltmeters, Ammaters, Milliammeters and Microammeters. Any type of laboratory or service equipment built to order. The Parkland Laboratories, 1660-62 E. 71st St., Chicago, Ill.

TROUBLE shooting in Superheterodyne Circuits is simplified with the Jeems Super Chart. Practically every known combination is instantly available to locate trouble in this circuit. Costs little—does much. 50c brings the chart, with full directions for its operation. Stamps (U. S.), Coin or Check. Roberts Radio Service, Caxton Bldg., Chicago, Ill.

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ENGLAND offers large market for American Radio Merchandise. We are the Largest Distributors of Radio Merchandise in the British Empire and Continental Europe. Manufacturers desiring to offer their products to this fertile field are requested to communicate with E. F. Heaver, Sales Manager, The Rothermel Radio Corporation, Ltd., 24-26 Maddox St., London, W. I.

CATALOG—Write for your copy (1929). Full List, Kits, Parts, Accessories. Low Prices. Nelson Electric Co., 508 S. Dearborn St., Chicago, Ill.

SUPERHETERODYNE for sale. The record breaker Magnaformer 9-8, in beautiful $200.00 Console (Pierson), has Thordarson B Eliminator. Complete with Tubes, Loop, Dynamic Speaker. $500.00 value for best offer over $150.00. Wonderful value. Will demonstrate. Radio Service Laboratories, 440 S. Dearborn St., (Room 675), Chicago, Ill.

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CUSTOM built radio sets out perform any other type sets on the market. Superheterodynes hold all records for distance and selectivity. Why not get the best? We build any type set or power amplifier to order. Radio Service Laboratories, Inc., 440 S. Dearborn St., Chicago, Ill.

POSTAGE stamps for collections. Interesting and instructive. We have single stamps and small and large collections for sale. Write for catalog. Metropolitan Stamp Co., Coans Theatre Bldg., 42nd and Broadway, New York City.

ARE you building a house? We will show you how to wire same for Radio. Write us your problems—our service department will show you how. Yaxley Mfg. Co., attention Mr. Sparrow, 9 S. Clinton St., Chicago, Illinois.

THIS CLASSIFIED SECTION IS A PERMANENT ADDITION TO THIS PUBLICATION

If you have anything special to sell—a small lot to clean out, or a special story to tell, this section will serve your purpose in the cheapest possible way and bring results that will be amazing.

Next issue on sale, November 1st. Four issues yearly, September, November, January and March.

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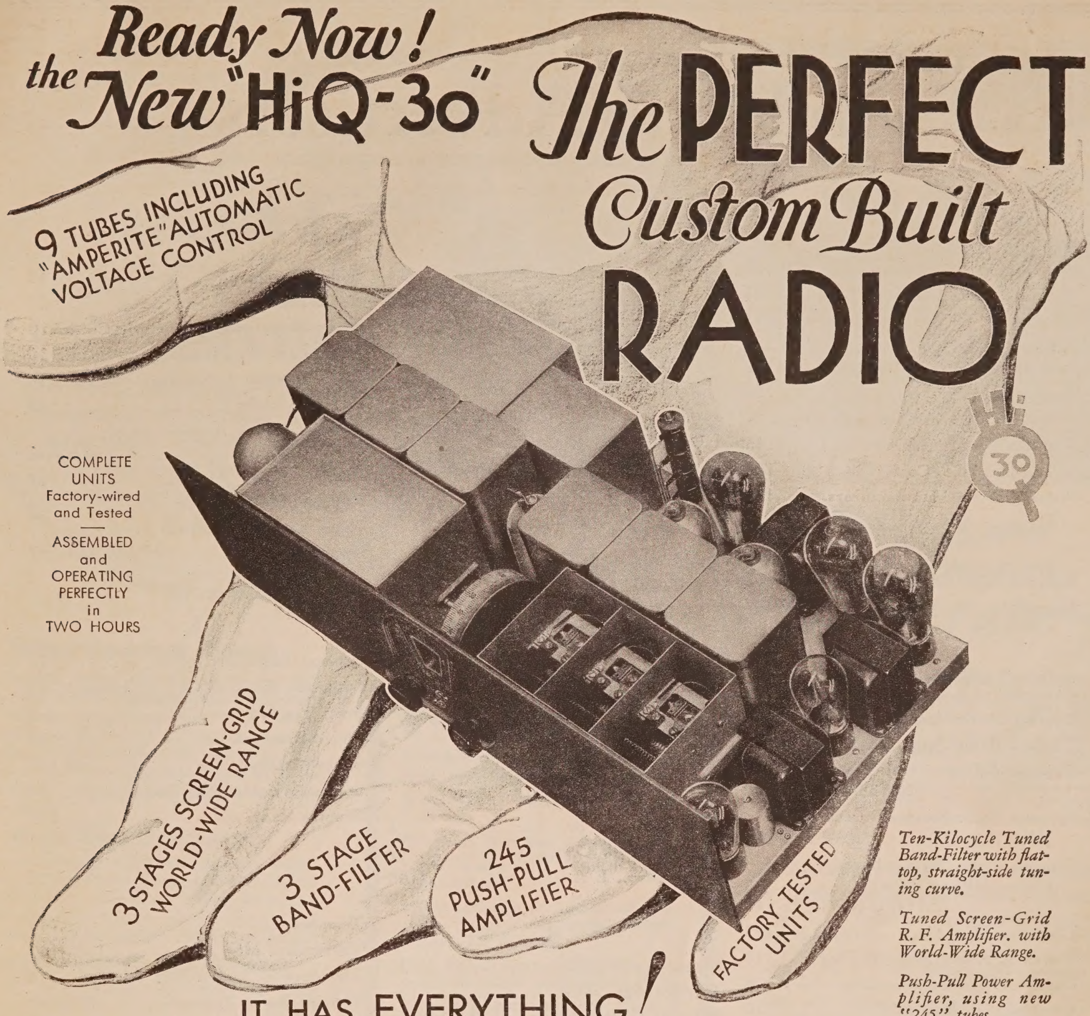
Ready Now! the New "HiQ-30"

The PERFECT Custom Built RADIO


9 TUBES INCLUDING "AMPERITE" AUTOMATIC VOLTAGE CONTROL
Hi Q 30
3 STAGES SCREEN-GRID WORLD-WIDE RANGE
3 STAGE BAND-FILTER
245 PUSH-PULL AMPLIFIER
FACTORY TESTED UNITS

COMPLETE UNITS
Factory-wired and Tested

ASSEMBLED and OPERATING PERFECTLY in TWO HOURS

IT HAS EVERYTHING!

THE new Hammarlund "HiQ-30" caps the climax of five years of custom-radio designing with two years of Screen-Grid development. Its epoch-making "Band-Filter" Circuit, *originated and used exclusively by Hammarlund* the past year, is the most advanced obtainable. Its parts are the finest—precision-designed especially for this truly great receiver.

The distance-getting ability of the "HiQ-30" is amazing. Stations do not merely "roll" in—they "SNAP" in, *one at a time,* free from cross-talk and background noises. No hum, no buzz—nothing but the crystal-clear program with startling realism and rare richness of tone.

A connection is included for reproducing phonograph records through the amplifier—as you have never heard them before.

Here is engineered radio perfection, clothed with beauty that delights the most fastidious. And all so easily acquired by either assembling it yourself with *factory-tested units,* or having it installed by your local custom-radio builder—at a price far less than any factory-built receiver that even approaches the "HiQ-30" in quality.

Don't buy or build *any* radio at *any* price until you get all of the "HiQ-30" facts. *The 48-page "HiQ-30 Manual" tells the story. Use the convenient coupon.*

HAMMARLUND-ROBERTS, INC.
424-438 W. 33rd Street, New York

COMPLETE
(*less tubes*)
$139.50 *to*
$1175.00

Ten-Kilocycle Tuned Band-Filter with flat-top, straight-side tuning curve.

Tuned Screen-Grid R. F. Amplifier. with World-Wide Range.

Push-Pull Power Amplifier, using new "245" tubes.

Tremendous volume, with a rich, vibrant tone that is revolutionary in radio.

One-Dial Operation.

Choice of Finest Cabinets and Speakers.

Completely-Shielded A. C. and Battery Models, with Cadmium-plated metal chassis.

MAIL COUPON AND 25¢ FOR "Hi Q-30" MANUAL!

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Enclosed 25c (*Stamps or Coin*) for the "HiQ-30" Manual.
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Index to Advertisers

A

Aerovox Wireless Corp. 128-138
Affiliated Hotels Bureau 143
Alden Mfg. Co. 35
Allied Radio Corp. 108-110-132-136-143-147
American Sales Co. 123
American Transformer Co. 29
Amplion Corp. of America 146
Arcturus Radio Co. 128
Aston Cabinet Manufacturers 119

B

Barawik Co., The 37-152
Braun Co., W. C. 1-107

C

Cameradio Co. 110-126
Central Radio Laboratories 120
Chicago Radio Apparatus Co., Inc. 109
Chicago Salvage Stock Store 110-130-134-138-140
Citizens Radio Service Bureau (Blue Prints) 144
Citizens Radio Service Bureau (Subscription Offers) 111-124-132-137-142
Clarostat Mfg. Co. 143
Classified Advertisements Page 148
Cornish Wire Co. 118
Cunningham, Inc., E. T. 120

D

Deutschmann Corp., Tobe 145
Drake Hotel, The 136

E

Electrad, Inc. 11
Elgin Radio Co. 13
Ensall Radio Laboratory 126
Excello Products Corp. 113

F

F & H Radio Laboratories 129
Ferranti, Inc. 137
Fort Shelby Hotel 125
Frost, Inc., Herbert H. 125

G

General Radio Co. 134
Governor Clinton, The Hotel 130
Gray & Danielson Mfg. Co. 25

H

Hammarlund Mfg. Co. 133
Hammarlund-Roberts, Inc. 149
High Frequency Laboratories 151
Hoodwin Co., Chas. 143

I

International Resistance Co. 119

J

J. M. P. Mfg. Co., Inc. 129
Jappe Co., H. 110
Jewell Electrical Instrument Co. 3

L

Leutz, Inc., C. R. 2
Lincoln Radio Corp. 17
Lund Corp., I. A. 108

M

Magnavox Co., The 23
Marlborough Hotel 146
Midwest Radio Corp. Third Cover
Mississippi Valley Radio Co. 139
Muter Co., Leslie F. Fourth Cover

N

National Co., Inc. 115
National Radio Institute 5
Nelson Electric Co. 141
New England Mills Co. 15-108
Norden-Hauck, Inc. 33

P

Pennsylvania, The Hotel 133
Pilot Radio & Tube Corp. 4
Polymet Mfg. Corp. 116
Pohl, Arthur M. 147
Potter Co., The 112

R

Radiall Company 147
Radio Institute of America 27
Radio Manufacturers' Supply Co. 110
Radio Parts Co., Inc. 130
Radio Service Laboratories, Inc. 146
Radio Specialty Co. 45
Radio Training Association of America Second Cover
Readrite Meter Works 114
Roberts Radio Service 125
Royal-Eastern Electrical Supply Co. 134-138-143-147

S

Samson Electric Co. 31
Sangamo Electric Co. Insert 32-33
Scott Transformer Co. 6-7
Shure Brothers Co. 109
Silver-Marshall, Inc. 104-105
Supreme Instrument Corp. 21
Surplus Radio Co. 143

T

Teleplex Co. 146
Thermatrol Mfg. Co. 122-140
Thordarson Electric Mfg. Co. 131
Thorola Radio Products 127-133
Townsend Laboratories 147
Triad Mfg. Co., Inc. 9

W

Wardman Park Hotel 126
Webster Co., The 135
Wedel Company 110
Western Radio Mfg. Co. 106-136-141
Weston Electrical Instrument Corp. 19
Wholesale Radio Service Co. 143
Workrite Radio Corp., The 121
Wright DeCoster, Inc. 117

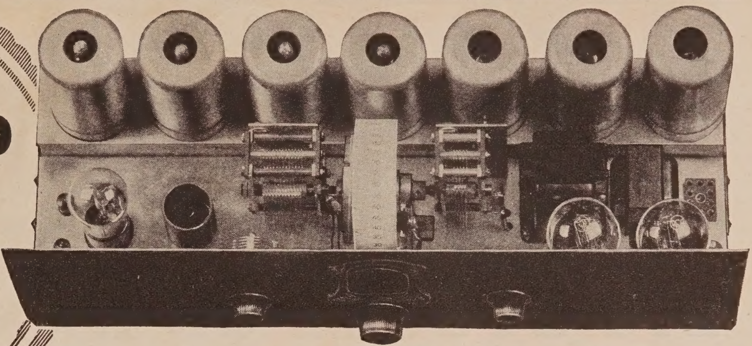
Y

Yaxley Mfg. Co. 113

THE NEW H·F·L·MASTERTONE

11 Tubes A·C· SCREEN-GRID Receiver

Humless, Noiseless, Efficient Operation. A receiver that Incorporates Every Advanced Engineering Practice, Magnificent Tone, Tremendous Volume.



Completely Built, Wired *and* Assembled by H·F·L Engineers *Shipped Ready to Operate*~

What Amazing Power

Amplification system built around the new AC Screen Grid tubes is especially adapted to intermediate frequency stages of superheterodyne receiver. No oscillation. Employs 5 screen grid tubes, the fifth being the detector, upon the plate of which is impressed 175 volts. This new system of power screen detection prevents overloading even at maximum volume.

Such Keen Sensitivity

Unlike any ever known, embracing every station, however weak or distant. Requires only wire screen or metal plate in cabinet for aerial to obtain coast to coast reception. Outside antenna may be used where louder signals or greater distances are desired.

Highly Developed Circuit

The intermediate employs four screen grid tubes with five tuned filter circuits, each one adjustable to peak of frequency to which they are tuned, assuring positive 10 kilocycle selectivity and defined clarity. The highly amplified signal is fed into the screen grid power detector, thence to the audio system. Most highly engineered receiver ever built.

H-F-L
Power
Master

Greatest *of all* RECEIVERS!

- **11 tubes operating at peak efficiency (5-224, 3-227, 2-245, 1-280)**
- **Single Dial Positive One-Spot Tuning**
- **Efficient, Humless AC Operation**
- **Uses 5 Screen Grid Tubes, 5 Tuned R. F. Circuits**
- **Fits practically all models of Consoles. Panel 7x21 inches. Depth, Chassis 7½ inches**
- **High Power Screen Grid Detector, with 175 Volts Impressed on Plate**
- **Automatic Line Voltage Control Inbuilt Holds Voltage Against Fluctuation**
- **100-Volt DC Dynamic Field Supply Incorporated**
- **All Metal Chassis—Completely Shielded Units**
- **3-Stage Phonographic Amplifier**
- **Finest Quality, Precision Made Parts: Thordarson, Carter, Mershon, etc.**

The New Audio System

Uniformity of amplification over entire musical scale is an outstanding achievement of Mastertone engineers. Absolutely free from hum. The first audio stage is followed by 245 tubes in push-pull arrangement. High plate voltage for these tubes is fed thru center tap push-pull impedance, permitting use of any type speaker. No actual B current feeds thru speaker. Operates with dynamic, magnetic or horn speakers.

Phonograph Reproduction and Other Mastertone Features

Plug-in jack for instant attachment of electric phonograph pick-up. Three stages of audio system employed for this purpose. Entire receiver sturdily constructed of heavy cadmium plated steel and copper. All stages and tubes are shielded. Condensers, coils and wiring completely enclosed. Front pan
is 7 x 21 inches. Depth of chassis, 7½ inches

H·F·L Power Maste

Designed to accommodate either AC or D
It is a specially developed unit of
receiver built separately to simplify
large, oversized transformer. Filte
with a heavy choke and the
Mershon Condensers of 24M
wave type 280 rectifier tu
and regulator levels out
age from 95 to 130
out if desired.

*A revolutionary achievement that sets up new star
years of painstaking research work and tests,
achieved—the H-F-L Mastertone—a receiver
power, its sweetness of tone—each unit per
accuracy and precision.*

Custom Built

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its production, yet the price is sur
We guarantee the Mastertone to
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Postal or letter brings Complete Description and Price

HIGH FREQUE
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Send for FREE RADIO GUIDE *from* RADIO HEADQUARTERS

BIG STOCKS ON HAND —All Ready for You

The active radio season has started. With the opening of another history-making year in radio, Barawik has had the pick of the bargains and is opening the season with a huge stock of quality goods at bargain prices. A large, carefully selected line in the newest models of factory-built sets, A. C., Screen Grid, etc., complete parts for circuits and hook-ups, accessories, parts, kits, etc., are described and listed in our new fall catalog.

Quick Service This Season

When our business greatly increased last year, and factories were slow in sending their merchandise, some of our customers' orders were occasionally delayed. This was unavoidable. This season we are laying our plans to avoid delays and give you the best service you ever had.

Try Out This New, Improved Service

You'll be surprised to see how fast your orders will be shipped—at the remarkable bargains we now offer—and the personal, considerate attention you will receive. Try out this new, improved service. You will be well pleased and delighted.

Another Big Bargain Book Ready for You

The new Barawik Radio Guide presents some of the most outstanding bargains you have ever seen. Your money goes far here. You'll be pleased with many new things contained in our new catalog.

This big new Radio Guide tells how to take advantage of the new things in radio. It shows how to get the best results from A. C. and D. C. Screen Grid sets and tubes, how to use remote control, how to get reception on front or back porch and lawn, while playing bridge, etc.; how to save money on tubes, speakers, supplies; how to make radio-phonograph combinations and public address systems, etc. Many new ideas with pictures, full descriptions and new low prices on anything you want in radio—sets, kits, parts and supplies—besides hundreds of necessities for your auto, for home, camp and outdoor use. Fill in the handy coupon below. It will bring you the latest edition. Be sure to send at once. Get the facts before you. Write today—NOW!

RADIO HEADQUARTERS
LATEST RADIO GUIDE
FREE BOOK

Headquarters for Walker's Multi-Unit

We are wholesale distributors for Walker's Multi-Unit, described elsewhere in this issue. Send your orders to us and save money on this 12-in-1 novelty appliance which is so useful for every Radio fan. We are also headquarters for Silver-Marshall, Aero Products, H. F. L., Hammarlund and all the famous circuits. All the above described in our new catalog. Be sure you get your copy at once.

The Barawik Co.

39 Canal Station **Chicago, U. S. A.**

FACTORY TO YOU—SAVE 50%—COMPARE WITH COSTLIEST OUTFITS BEFORE YOU BUY

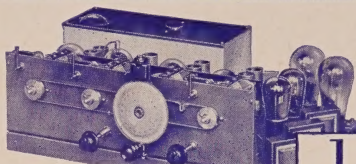
—a powerful new Miraco

set or complete outfit

30 DAYS FREE

Electric or Battery

Get Our Send No Money 10th Anniversary Offer!



1 YEAR GUAR.

9 tube

lighted 1-dial, steel chassis

perfected SCREEN GRID—

latest PUSH-PULL Amplification

New SCREEN AERIAL Console SUPER-DYNAMIC Cathedral Tone!

Mastercrest-built with beautiful genuine walnut; sparkling maple panels; 4-way matched sliding doors. Lifting top. Concealed SCREEN aerial makes outdoor aerial unnecessary. Super-Dynamic Cathedral Tone Reproducer.

Built like—looks like—performs like newest sets in many outfits up to $300! Latest, finest, costliest construction! Uses "224" SCREEN GRID, "245" PUSH-PULL POWER, "227" HUM-FREE POWER DETECTOR AND "280" RECTIFIER AC TUBES. Phonograph pick-up connection. Local-Distance switch. Built-in power section on steel shielded chassis. Lighted one-dial tuning. Razor-edge selectivity; super-dynamic cathedral tone quality; marvelous distance getter. Solid one-year guarantee if you buy it for

Only $49.88

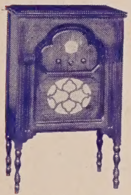
COMPLETELY ASSEMBLED

Values possible because you deal direct with big factory

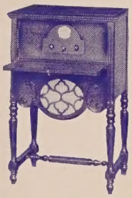
NEW LOW FACTORY PRICES SAVE 50%

Beautiful Variety of Latest Fine Consoles, AC or Battery Sets

30 DAYS FREE TRIAL



Richly designed, latest type, Lo-Boy Mastercrest console; beautiful two-tone finish in walnut. A gem that costs little. Hinged top lid.



An exquisitely new and fine, genuine walnut desk-type Mastercrest console. Very pretty and a rare bargain. Hinged top.

Spanish Treasure chest design, Mastercrest console. Finest selected grain, solid walnut. Antique wrought hardware. Marvelous value. Hinged top.

These Consoles are Equipped with

SUPER DYNAMIC

CATHEDRAL TONE REPRODUCERS

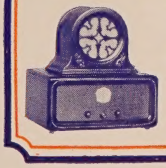


Table compact style Mastercrest cabinet in handsome walnut and gold-striped finish. Separate Cathedral Tone Super-Dynamic Speaker to match. Wonderful bargain!

MIRACO

TRADE MARK REGISTERED

CATHEDRAL TONED, SUPER SELECTIVE, POWERFUL DISTANCE GETTERS

You needn't send us a cent! America's big, old, reliable Radio Factory springs its 10th Anniversary Surprise in high-grade, 1-year guaranteed sets at history's lowest prices! With its latest perfected Screen-Grid, push-pull, super-powered and hum-free AC electric Miraco's—you are guaranteed satisfaction, values and savings unsurpassed. *Get Amazing Special Offer!*

At our risk compare a Miraco with highest priced radios, for 30 days in your home. Surprise and entertain your friends—get *their* opinions. Unless 100% delighted, *don't buy!* Your decision is final—no argument!

Only marvelously fine radios, of latest perfected type, at rock-bottom prices, can back up such a guarantee. Send postal or coupon for *Amazing Special Factory Offer!*

USER-AGENTS WANTED

Exclusive Territory—Demonstrator Supplied

Spare or full time. No contract, no experience required. Big money! Send coupon now!

Don't Confuse with Cheap Radios

With Miraco's rich, clear cathedral tone, quiet operation, razor-sharp separation of nearby stations, tremendous "kick" on distant stations and latest improvements—you'll be the envy of many who pay 2 or 3 times as much!

Send for proof that delighted thousands of Miraco users cut through locals, get coast to coast, with tone and power of costly sets. Miraco's are custom-built of finest parts—product of 10 years' successful experience. Approved by Radio's highest authorities.

Deal Direct with Big Factory

Miraco outfits reach you splendidly packed, rigidly tested *with everything in place ready to plug in!* No assembling! Entertain yourself 30 days—then decide. Liberal one-year guarantee on each set. Play safe, save lots of money, insure satisfaction—deal direct with Radio's old, reliable builders of fine sets—10th successful year. SEND POSTAL OR COUPON NOW for Amazing Offer!

Special! Electric Super AC-7 $39.85

SEND for AMAZING SPECIAL OFFER

MIDWEST RADIO CORP., 531-AS Miraco Bldg., Cincinnati, Ohio

BEAUTIFULLY ILLUSTRATED LITERATURE, AMAZING SPECIAL FACTORY OFFER, TESTIMONY OF NEARBY USERS—

All the proof you want—of our honesty, fairness, size, financial integrity, radio experience and the performance of our sets—including Amazing Factory Offer—sent without obligation!

Dealers Write!

USERS' REPORTS PROVE THAT
MIRACO
Radio
gets 'em
Coast to Coast

Free!

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets—10th Successful Year
531-AS Miraco Bldg., Cincinnati, Ohio

THIS COUPON IS NOT AN ORDER

WITHOUT OBLIGATION, send latest literature, Amazing Special Free Trial Wholesale Price Offer, testimony of nearby users, and all Proof. ☐ User ☐ Agent ☐ Dealer

☐**Check here if interested in an EXCLUSIVE TERRITORY PROPOSITION**

NAME ADDRESS

REPLACE

that old Magnetic Speaker

or that out-dated Dynamic

with the NEW 1930

MUTER

No. 4610—110 Volt A. C. Unit

ULTRA-DYNAMIC SPEAKER

Muter presents the new idea for old sets—a replacement speaker which brings your set up-to-date, and gives it a marvelous, rich tone. Any dealer will be glad to demonstrate the MUTER ULTRA-DYNAMIC SPEAKER. You will be amazed at its quiet, humless operation, its freedom from excessive "drumming" on low notes, and its live, natural tone.

You can have the Muter, as shown at the left, to place in your cabinet, or in either of the cabinet models shown below. Prices are remarkably low for this outstanding speaker.

LESLIE F. MUTER COMPANY
8440 South Chicago Avenue
Chicago

DESCRIPTION—UNITS ONLY

Stock No. 4610
110-Volt 60 Cycle A. C. Unit (less tube)
List, $27.50

Stock No. 4690
90-Volt Direct Current Unit
List, $25.00

Stock No. 4606
6-Volt Direct Current Unit
List, $22.50

IF YOUR DEALER CANNOT SUPPLY
SEND DIRECT

No. 4625
—Consolette

MEMBER
R.M.A.

DESCRIPTION

Stock No. 4615
Table Cabinet only
$15.00

Stock No. 4625
Consolette Cabinet only
$25.00

MUTER

No. 4615—Table Cabinet

Any unit of the MUTER speaker may be had in either the handsome table model, or consolette shown. Artistic in design, beautifully finished walnut.